# The supply and demand for timber, recreation, and community forest outputs from forests in Great Britain

by

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# CHAPTER 4

## FOREST RECREATION

### 4.1 THE HOUSEHOLD SURVEY OF FOREST VISITORS 1987-1991

As was discussed in Chapter 2, two approaches can be used to examine recreation in the countryside: physical counting of participants by monitoring sites or traffic movements close to recreation facilities, or household surveys of the use of leisure time. Site based monitoring has been used extensively in the past by the Forestry Commission to measure visits to its own estate. However, household surveys are more useful for measuring visits to all types of forests, and the surveys undertaken during 1987-91 were the first detailed attempt to examine forest visitor numbers using this technique.

This section discusses the household survey of forest recreation undertaken over the period 1987-1991. It starts with a discussion of the survey and questionnaire design then examines the spatial and seasonal coverage of the surveys that were carried out. It finishes by highlighting the problems that were encountered in the surveys and their implications for the interpretation of the results.

Data collection methods

Data on forest visits were collected by the means of face-to-face interviews with individuals conducted in their own homes. Interviewers used set questionnaires offering for most questions a limited number of responses and all responses were for the individuals themselves rather than their household. The analysis of all the results was performed by the author, but the questionnaire was designed by the Forestry Commission's Environment Section and the survey design and interviewing was carried out on behalf of the Forestry Commission by independent market researchers meeting the Market Research Society's Quality Control Standard (System-Three Scotland in Scotland and Taylor Nelson Limited in England and Wales). Each firm used slightly different sampling techniques.

In England and Wales, questions were put into an omnibus survey which included questions about the use of many other products as well as forests. This survey which runs every week of the year, was used several times a year. The sample size was approximately 2,400 each week across the whole of Great Britain of which about 2,000 interviews were conducted in England and Wales. The sampling frame for the survey was all individuals in England and Wales aged 16 and over.

A rolling multi-stage probability sample was drawn in each month of the survey, using electoral constituencies and electoral registers to supply units for sampling. From 286 randomly selected electoral constituencies in England and Wales a smaller sample of constituencies was drawn each month. A random sample was then taken from the electoral registers of these constituencies to give a set of sampling points. Substitution of sampling points by other points was only allowed if an individual had moved since the register had been compiled. Special procedures were used to select 16 and 17 year olds and individuals recently moved to the area. Interviews were conducted face to face in respondent's homes during evenings and weekends only. Repeated calls were made until contact had been established and a 10% back check was conducted by the company to ensure that interview standards were being maintained.

In Scotland, questions were also added to an omnibus survey: the Scottish Opinion Survey. This survey is undertaken monthly, and similar questions to those posed in England and Wales were inserted in some of the months. Sample size was approximately 1,000 adults selected to be representative of the Scottish adult population in terms of age, sex and social class. For the purposes of selecting a sample, an adult was defined as being aged 15 or over.

Forty sampling points were selected throughout Scotland each month, stratified on the basis of geographical location and the party of the current Member of Parliament. From each of these points, a quota sample was then taken, starting from a randomly selected address and using a random route procedure. Quotas were set on the basis of age, sex and social class, and the composition of the population against which these quotas were set was taken from the most recent National Readership Survey in each year. In contrast to the surveys in England and Wales, interviews were conducted at a range of times throughout the day, but the quota controls were used to ensure that as little bias as possible was being introduced into the sample through the sampling technique. Non-response was handled by interviewing individuals living either side alternatively of each chosen address if the respondent could not be contacted after four attempts.

For the purpose of interpreting the results weights were calculated for each of the responses in both Scotland and England and Wales, based on a matrix of socio-economic characteristics (age, sex and social class). These weights were essential for interpreting the results from Scotland because of the mixture of random and quota controlled techniques used to draw the sample. The sample in England and Wales was drawn using only random sampling methods so it was not essential to weight the results. However the weights were used to interpret the results because it was thought likely that the effect of random sampling error would be reduced and the results therefore be improved by doing this.

The questionnaires were not designed purposefully for this research (which led to some problems that are discussed later) but were designed to be consistent with other existing household surveys of recreation demand. From 1987 to 1989 the survey in Scotland made up part of the Scottish Leisure Day Trip Survey used by the Countryside Commission for Scotland and the definitions and questions used were largely determined by what was already being used in that survey. After that, the surveys in Scotland, along with all the surveys in England and Wales, were carried out independently of surveys run by other agencies. However the questionnaires were designed to be similar in their format and the types of questions being asked to the other surveys because the results of some of these other surveys were necessary to interpret the results of the forest visitor survey. This did mean therefore, that the design of the questionnaires was largely inherited and outside the control of this work.

Examples of the questionnaires used are given in Appendix 1. Each questionnaire contained three main elements:

1. a coded question or questions about how often the respondent had been to a forest within a given recall period (eg on their last visit or within the last 4 weeks);
2. a set of coded questions about what they did on their last visit; and

3. an open-ended or free response question about where the forest was, what it was called, and who owned it.

The first element was designed to enable the responses to be aggregated into a total estimate of forest visitor numbers, the second to provide some qualitative information about visits and the third to identify which visits were to the Forestry Commission estate and which were to other forests. Although not the original intention, the third element also provided useful information on the supply of forests for recreation which will be discussed later. In addition to these three elements, socio-economic data was also collected as part of the survey, and in England and Wales (but not in Scotland) the location of each interview was also recorded as part of the data set.

Data coverage

As with the questionnaire design, the timing of surveys was largely outwith the control of this research, and the dates during which interviews took place (see Table 4.1.1) were selected to be compatible with other leisure surveys. The sampling strategy in Scotland from 1987-1989 was to have surveys every 2 months, plus the month of July, to capture extra information about the high number of visits expected in the summer season (surveys covering December were held over until the beginning of January the following year). In 1989 two extra surveys were also carried out in March and May, asking a more limited number of questions about forest visits. Surveying in England and Wales was less structured. Six surveys were undertaken in 1987, one in 1988 and nine in 1989; the timing of the surveys in 1989 was broadly comparable to the timing of surveys carried out in Scotland in that

Table 4.1.1 Survey dates of the Forestry Commission visitor survey 1987 – 91

| England and Wales | | | | Scotland | | | |
|---|---|---|---|---|---|---|---|
| Survey dates Start | Finish | Period covered | Sample size | Survey dates Start | Finish | Period covered | Sample size |
| 20-Mar-87 | 24-Mar-87 | March/April | 1,177 | 19-Feb-87 | 24-Feb-87 | February | 998 |
| 05-Jun-87 | 09-Jun-87 | April/May | 1,199 | 23-Apr-87 | 28-Apr-87 | April | 973 |
| 03-Jul-87 | 07-Jul-87 | May/June | 1,299 | 25-Jun-87 | 30-Jun-87 | June | 1,052 |
| 07-Aug-87 | 11-Aug-87 | June/July | 1,244 | 23-Jul-87 | 28-Jul-87 | July | 1,001 |
| 04-Sep-87 | 08-Sep-87 | July/August | 1,185 | 27-Aug-87 | 01-Sep-87 | August | 1,011 |
| 06-Nov-87 | 10-Nov-87 | September/October | 1,242 | 22-Oct-87 | 27-Oct-87 | October | 1,035 |
| | | | | 07-Jan-88 | 14-Jan-88 | December | 997 |
| | | Total | 7,346 | | | Total | 7,067 |
| | | | | 26-Feb-88 | 06-Mar-88 | February | 969 |
| | | | | 28-Apr-88 | 03-May-88 | April | 1,069 |
| | | | | 23-Jun-88 | 28-Jun-88 | June | 987 |
| | | | | 21-Jul-88 | 26-Jul-88 | July | 981 |
| 16-Sep-88 | 20-Sep-88 | August/September | 2,102 | 25-Aug-88 | 30-Aug-88 | August | 1,022 |
| | | | | 20-Oct-88 | 03-Nov-88 | October | 999 |
| 06-Jan-89 | 10-Jan-89 | November/December | 2,054 | 06-Jan-89 | 13-Jan-89 | December | 960 |
| | | Total | 4,156 | | | Total | 6,987 |
| 24-Feb-89 | 28-Feb-89 | January/February | 2,092 | 23-Feb-89 | 28-Feb-89 | February | 1,024 |
| 31-Mar-89 | 04-Apr-89 | February/March | 2,045 | 27-Mar-89 | 03-Apr-89 | March | 967 |
| 28-Apr-89 | 03-May-89 | March/April | 2,156 | 27-Apr-89 | 02-May-89 | April | 1,027 |
| 26-May-89 | 31-May-89 | April/May | 2,082 | 25-May-89 | 30-May-89 | May | 967 |
| 23-Jun-89 | 27-Jun-89 | May/June | 2,249 | 22-Jun-89 | 27-Jun-89 | June | 992 |
| 28-Jul-89 | 01-Aug-89 | June/July | 2,034 | 27-Jul-89 | 01-Aug-89 | July | 959 |
| 18-Aug-89 | 29-Aug-89 | July/August | 2,374 | 24-Aug-89 | 29-Aug-89 | August | 982 |
| 27-Oct-89 | 01-Nov-89 | September/October | 1,841 | 26-Oct-89 | 31-Oct-89 | October | 1,048 |
| | | | | 05-Jan-90 | 12-Jan-90 | December | 1,015 |
| | | Total | 16,873 | | | Total | 8,981 |
| 04-May-90 | 09-May-90 | April | 2,145 | 25-Apr-90 | 30-Apr-90 | April | 974 |
| 03-Aug-90 | 07-Aug-90 | July | 2,120 | 23-Aug-90 | 28-Aug-90 | August | 1,062 |
| 02-Nov-90 | 06-Nov-90 | October | 1,951 | 25-Oct-90 | 30-Oct-90 | October | 1,059 |
| | | Total | 6,216 | | | Total | 3,095 |
| 26-Apr-91 | 30-Apr-91 | April | 2,299 | 25-Apr-91 | 30-Apr-91 | April | 1,016 |
| 09-Aug-91 | 13-Aug-91 | July | 1,908 | 25-Jul-91 | 30-Jul-91 | July | 1,020 |
| 01-Nov-91 | 05-Nov-91 | October | 1,653 | 24-Oct-91 | 29-Oct-91 | October | 1,046 |
| | | Total | 5,860 | | | Total | 3,082 |

year. During 1990 and 1991 the surveying strategy was changed to one of having 3 surveys undertaken covering April, July and October in both Scotland and England/Wales, and this was achieved with the exception of one survey in Scotland in 1990, when August was mistakenly surveyed instead of July.

Table 4.1.1 also shows the sample size for the surveys conducted from 1987-1991. The samples were large enough to give reasonably accurate estimates of forest recreation in each of the months for the whole of Scotland and England/Wales. They were not however large enough to give very accurate regional estimates of recreation nor estimates of recreation to particular forests (with the exception perhaps of New Forest which was mentioned in a significant proportion of the responses), although they were large enough to give quite accurate estimates of recreation to broadly defined categories of forest ownership.

The surveys in Scotland from 1987-1989 enquired about forest visits in the previous 4 weeks, and provided an adequate distribution of surveys through time to give reasonably unbiased results if it is assumed that the responses in the months outside the summer season are reasonable estimates of adjacent months' visitation patterns (eg the survey results covering December could be applied to November or the following January). The surveys in England and Wales over the same period had a recall period of the previous 2 months rather than the previous 4 weeks leading to overlapping recall periods for some of the months in 1987 and 1989, and giving adequate seasonal coverage of forest visitor patterns in these years. With only one survey in 1988, it was not possible to make an accurate estimate of visits during the whole of that year. In 1990 and 1991, the recall period in both Scotland and England/Wales was set to the previous 4 weeks and the questionnaires used in both regions were standardised. However, the frequency of surveys was reduced to only 3 months of the year which reduced the reliability of any annual estimates made on the basis of these figures.

Figures 4.1.1 to 4.1.2 show the distribution of interviews by county in England and Wales (aggregated from the parliamentary constituencies) and by local authority region in Scotland. It can be seen that interviews were conducted at a wide range of locations that gave a reasonable geographical spread for the survey as a whole, and were therefore unlikely to cause bias in the results due to the location of interviews. As a further check, the proportion of interviews conducted in rural and urban locations in England and Wales was also calculated and compared with the average proportion of the population that lives in urban areas. This showed that there was a slight amount of bias towards interviewing in urban locations (the proportion of the responses from urban locations in the sample varied from 50-54% compared to only 47% of the population living in such areas as a whole.

Problems encountered with the survey design

As with any questionnaire survey, the responses to the survey can be very sensitive to the way questions are asked and this certainly occurred in the forest visitor survey. Changes in the definition of a visit, recall period, and ways in which the forest visit was separated out from other leisure visits in the surveys all led to differences in the results which had to be interpreted with care. A further problem arose because respondents were allowed to decide for themselves what

Figure 4 . 1 . 1 Visitor survey sample sizes 1989

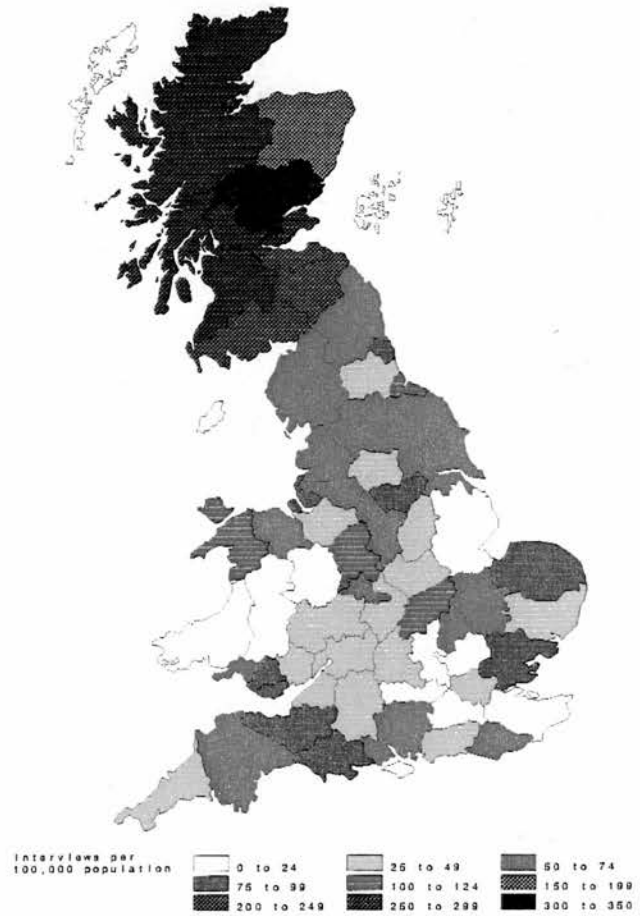
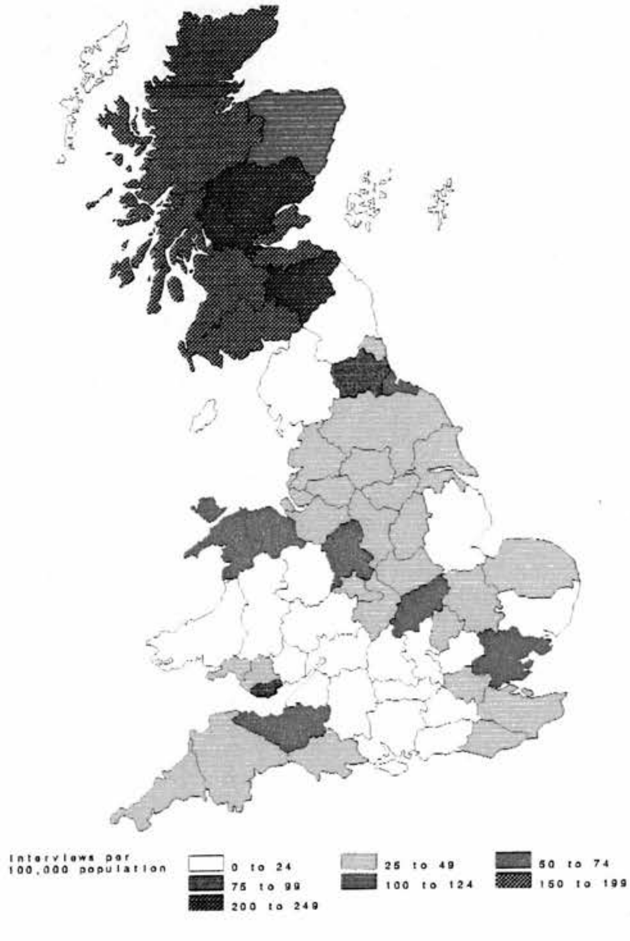


Figure 4.1.2 Visitor survey sample sizes 1990/91



constituted a forest. This interestingly led to a range of definitions from a few trees in a park or copse to large tracts of plantation entering into respondents' minds as forests visited. The free-response nature of the questions on location, name and ownership also led to difficulties in identifying exactly where the forest visits had been made.

Over the whole period 1987 to 1991 changes were made to the questionnaires in the following areas:

1. The definition of a visit;
2. The definition of a forest visit;
3. The way in which forest visits were separated from other visits;
4. The information collected about forest visits; and
5. The recall period used in the survey.

From 1987-1989, visits were defined as a trip away from home (or a holiday destination) lasting for more than three hours including travelling time. In England and Wales a visit was defined as an outing to the countryside whereas in Scotland it was defined as an outing to take part in a leisure activity (with a long list of possible activities being given to respondents as suggestions). The way in which forest visits were then separated out from other visits was however changed during the period. In 1987 respondents were given a number of suggestions as to what sort of site they had visited on their last outing. (Three choices in England and Wales: Woodland or forest; Mountain or moorland; and elsewhere in the countryside; and a much longer list of possible sites in Scotland). This changed in 1988-89 when respondents were simply asked if their last outing had been to a woodland or forest.

In 1990 and 1991 this two-stage process of asking about all visits and then the last visit was replaced by a much simpler question asking if the respondent had been to a forest or woodland within a specified period. No lower time limit was set for the definition of a visit, and no longer was a forest visit only counted if it had been the most recent outing made.

The way information about forest visits was collected in 1987-1989 can be criticised on two counts. Firstly, it made analysis more complicated because it required the total number of all visits to be known before the proportion of visits made to forests could be used to identify the number of forest visits out of this total. Secondly, it required the assumption to be made that the proportion of most recent visits being made to forests was an unbiased estimate of the proportion of all visits being made to forests. This might be invalid if, for example, the proportion of outings on a Sunday that are to forests is different to the proportion of outings made during the rest of the week, and visits made on a Sunday are over-represented in the sample due to the times during the week at which interviews took place. However, it was felt that this bias was likely to be small. The way forest visits were identified in 1990-1991 was an improvement on this although the removal of the lower time limit in these surveys then made it difficult to compare these results to those obtained earlier.

The information collected about forest visits also changed over the period. From May 1989 onwards in England and Wales and 1990 onwards in

Scotland, information about party size, distance travelled, spending on the outing and starting location of the visit (ie from home or a holiday destination) was collected in addition to information about where the forest was, how the respondent found it, and what they did when they got there. While this did not affect the estimation of total adult visitor numbers, it did allow the number of children making visits to be estimated (children were not included as respondents in the survey) and provided valuable information on the effect of distance on visitation (a complicating factor here was those respondents that had started their visit from a holiday destination - a point which is considered further later on).

The quality of responses to any questionnaire depends greatly on the length of time in the past over which the respondent is expected to remember (the recall period). Greater errors can be expected with longer recall periods and if more detailed questions are asked in the survey. There is also the question of whether respondents are more or less inclined to include events that strictly did not occur within the recall period if the recall period is short or long (for a review of the effect of recall period on survey accuracy see Moser and Kalton, 1986). To get reasonably accurate results the detailed questions about forest visits were only asked about the most recent visit given that either the most recent visit had been to a forest (1987-1989) or a forest visit had been made in the last 4 weeks (1990-91). As has already been discussed, the surveys in Scotland used a recall period of the previous 4 weeks, while in England and Wales the recall period was firstly the previous 2 months (1987-89) then the previous 4 weeks (1990-91). Again, a problem with the two-step design used in 1987-89 was that to interpret the results it had to assumed that the proportion of respondents that had been to a forest on the last occasion and been out within the recall period was the same as the proportion that had been to a forest on the last occasion but not been out during the recall period. If infrequent visitors (on any type of trip) are more or less likely to visit forests than those that had made any sort of visit within the recall period, this assumption would be invalid and would lead in errors in the results.

It was thought likely that respondents probably could remember reasonably accurately where they had been on their last visit if it had been made within the past 2 months, and that the improved accuracy of the results due to the reduction of the recall period to 4 weeks in England and Wales from 1990 onwards was probably counterbalanced by the increased difficulty of the forest visit questions asked (ie respondents were no longer just asked if they had been to a forest on their last outing, but were asked if they had been to a forest in the last 4 weeks and, if so, how many times). The Scottish results (where the recall period for visits was only 4 weeks in all the surveys) were thought likely to be slightly more accurate than those in England and Wales because of the shorter recall period in earlier years and the relatively larger proportion of the population sampled in each year.

The lack of a definition of a forest, and the free response allowed for the name and location of the forest visited also created some difficulties in interpreting the results. This led to a considerable amount of effort having to be devoted to identifying and checking all the responses, but it also provided valuable information about what respondents considered to be woodlands and allowed a large database of forest sites to be constructed containing sites which would otherwise have been considered irrelevant. On balance, the collection and collation of this information was in itself a major useful output of the research.

Conclusions

This section has discussed how household surveys were used to collect information on forest visitor numbers from 1987 to 1991. The survey design was largely inherited from others and changes over the period to the questionnaires that were used are likely to lead to problems in interpreting the results. However, in terms of the seasonal and geographical coverage of the survey, the design was adequate to give reasonably accurate and unbiased results for most of the years. The last part of this section touched on how changes to the questionnaire are likely to require different calculations to be made to estimate total forest visitor numbers, which is the subject of the next section of this chapter.

## 4.2 AN ESTIMATE OF VISITORS TO FORESTS IN GREAT BRITAIN

The previous section discussed how data on forest visits was collected from 1987-91. This section describes the methods by which this data was used to calculate an estimate of forest visitor numbers and presents estimates for each of the years. These are then compared to previous estimates and the main features of the results are described. It finishes by discussing the main characteristics of forest visitors and the implications of these results for modelling recreation demand.

### Methodology

As has been shown, the question asking whether a respondent had been to a forest recently was asked differently in 1987-89 and 1990-91. This required different calculations to be made to estimate total forest visitor numbers from the sample survey results.

From 1987-89 respondents were asked if they had been out in the last 2 months (England and Wales) or 4 weeks (Scotland) and whether their last outing had been to a forest or woodland. From this, the probability that their last outing was to a forest, given that a countryside trip had been made was estimated by dividing the number of respondents making forest visits by the number of respondents having been out. Mathematically, this can be represented as:

$$p(F|C)_t = n(f)/n(c)_t$$

Where $p(F|C)_t$ is the conditional probability of having been to a forest on the last outing given that the respondent has been out during time t;

n(f) is the number answering yes to the question about their last visit having been to a forest; and

n(c) is the number of respondents that have been out during time t.

This conditional probability was then used to estimate how many forest trips have been made by respondents over the given period using the following equation:

$$N(F)_t = N(C)_t \times p(F|C)_t$$

where $N(F)_t$ is the total number of forest visits made by respondents during time t; and $N(C)_t$ is the total number of outings made by respondents during time t.

That is, that the number of forest visits made by respondents is equal to the total number of outings made multiplied by the probability that an outing would have been to a forest. As was discussed in the previous section, this required that the assumption be made that by asking about the last visit within a given response period the responses gave an unbiased estimate of $p(F|C)_t$.

Estimation of $N(F)_t$ therefore required the total number of outings to be known, and from this, the total number of forest visits could be estimated by grossing-up the sample size to the population and aggregating the results across all months of the survey (correcting for missing months by weighting each month's results to give a 12 month estimate). However, a problem arose in that the total number of outings made by respondents was not collected in the survey.

Information about the probability of having been out was collected but, many respondents would have been out on more than one occasion, and the average number of outings would be required to estimate the total number of outings for the sample as a whole. Fortunately the total number of leisure outings (in Scotland) or countryside outings (in England and Wales) was available from other sources. This had been collected as part of the same survey in Scotland and from a very similar survey (using similar definitions and survey methodology) in England and Wales by the two Countryside Commissions. The estimate of total forest visitor numbers was therefore calculated by applying this conditional probability $p(F|C)_t$ to the total number of outings recorded in these surveys.

Given that the total number of forest visitors could be estimated by using the probability $p(F|C)_t$ and the total number of outings recorded in these surveys, the question then remained as to how to arrive at an unbiased estimate of $p(F|C)_t$ for each year as a whole. Two issues had to be considered, the appropriate weighting of each month's estimates of $p(F|C)_t$ to arrive at an annual average, and the question of whether weighted or unweighted sample results should be used.

The sample selection method employed in England and Wales was random, which should strictly speaking give statistically unbiased estimates, but a mixture of random and quota sampling was used in Scotland. Because quota sampling can be biased each result must be weighted according to the variables by which the quota was set. Such weights correct for any discrepancy between the socio-economic structure of the sample taken and the socio-economic structure of the population it is meant to represent. The weights in Scotland were calculated on the basis of age, sex, social class and party of the local MP. These were presented along with the rest of the data in the data set and the weighted number of visits made was used to calculate $p(F|C)_t$. Weights were also given based on age, sex and social class for the results obtained in England and Wales. Although this sample was selected randomly, the sample size was still relatively small (about one-hundredth of one per cent of the total population) and the weights showed that some socio-economic groups were under represented in the sample. Later analysis of the results showed that these socio-economic factors strongly affected participation so it was thought likely that weighting the results would reduce sample error and the weighted results were consequently used in the calculation of $p(F|C)_t$ in England and Wales as well as Scotland.

To estimate an average annual $p(F|C)$ the individual monthly results were weighted to account for the number of intervening months between surveys and year-ends when surveys did not take place. Because the survey design in Scotland did not change over the period 1987-88 this resulted in the same set of weights being calculated for each month in all 3 years. With a much more haphazard series of surveys in England and Wales the weights varied and were also calculated to take into account overlapping survey periods. It was felt that, with the exception of the results for England and Wales in 1988, the number of months surveyed was sufficient for this weighting system to give reasonably accurate and unbiased estimates of $p(F|C)$ for each year as a whole. This however, also assumed that $p(F|C)$ was not correlated with the total number of monthly visits (on all types of trip) made by respondents. If it was then the yearly $p(F|C)$ calculated could be biased, but monthly visitor number statistics were not available to test this hypothesis.

During 1990 and 1991, the question on forest visits changed, and respondents were asked if they had been to a forest in the last 4 weeks, and if so, how many times. This was easier to analyse as the average number of forest visitors in the sample over each period could simply be calculated as:

$$N(F)_t = n(F=1)_t + 2n(F=2)_t + 3n(F=3)_t + \ldots\ldots + Qn(F\text{-}Q)_t$$

Where $n(F=1)_t$ is the number that had been once during time t; $n(F=2)_t$ the number that had been twice etc; and Q is the largest number of outings recorded in the survey (this was coded as 8 or more and was assumed to equal 11).

This could then be simply grossed-up to the whole population for each month (using the weighted results for the same reasons as discussed above) and aggregated across months to arrive at an annual total. However, because the number of months of the survey was reduced to only three per year, it was considered that simply weighting the monthly results by the number of intervening months in which surveys had not taken place might not give very accurate results, so results were also calculated using an alternative system for comparison with those calculated in the simpler way.

In the alternative weighting system each of the monthly results were converted to "average" monthly results based on the proportion of total yearly visits (on all types of trip) that would be expected in those months taken from other Countryside Commission survey results. The results were then averaged and multiplied by 13/3 (bearing in mind the "month" was actually a 4 week period) to arrive at annual results. So, for example, the average number of visitors to the countryside in England and Wales during April was approximately one-thirteenth of the total visitor numbers in a year from 1984-87 which made it an "average" month ie with a weight of 0.0769. July on the other hand accounted for 10.0% of annual countryside visits over the same period (31% higher than the monthly average) so results in this month had to be multiplied by 0.0586 to convert them into "average" month results. Once the three monthly results were then converted to "average" monthly results, they were then added and multiplied by 13/3 to arrive at an annual total. In effect this gave each of the 3 months equal weight in arriving at the total without giving extra weight to July or less weight to October because a greater or lesser number of visits (of all types) took place in these months.

Estimated forest visitor numbers

The results of the household surveys from 1987-89 are shown in Table 4.2.1. The first interesting point to note is the much higher proportion of visits to forests in England and Wales recorded in 1987 compared to 1988 and 1989. This is probably due to the difference in the way the question was framed. In 1987, the question about the location of the last countryside outing forced respondents to give one of three locations as an answer:

a. Woodland or forest.

b. Mountain or moorland.

c. Elsewhere in the countryside.

In 1988 and 1989 the question was rephrased to give respondents these five alternative locations in their response:

Table 4.2.1 Proportion of countryside outings (England and Wales) or leisure trips (Scotland) recorded as having been to woodland on the last occasion

| England and Wales | | | | | | Scotland | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Period covered | Weight | Sample size | Number been out | Woodland on last trip: Number | Woodland on last trip: Proportion | Period covered | Weight | Sample size | Number been out | Woodland on last trip: Number | Woodland on last trip: Proportion |
| 1987 | | | | | | | | | | | |
| March/April | 0.29 | 1,177 | 282 | 107 | 38% | February | 0.21 | 998 | 480 | 55 | 11% |
| April/May | 0.08 | 1,199 | 516 | 165 | 32% | April | 0.17 | 973 | 568 | 55 | 10% |
| May/June | 0.08 | 1,299 | 611 | 165 | 27% | June | 0.13 | 1,052 | 628 | 60 | 10% |
| June/July | 0.08 | 1,244 | 560 | 134 | 24% | July | 0.08 | 1,001 | 590 | 53 | 9% |
| July/August | 0.13 | 1,185 | 569 | 142 | 25% | August | 0.13 | 1,011 | 694 | 77 | 11% |
| September/October | 0.33 | 1,242 | 447 | 148 | 33% | October | 0.17 | 1,035 | 525 | 31 | 6% |
| | | | | | | December | 0.13 | 997 | 444 | 26 | 6% |
| Total/weighted proportion | | 7,346 | 2,985 | 861 | 32% | Total/weighted proportion | | 7,067 | 3,929 | 357 | 9% |
| 1988 | | | | | | | | | | | |
| | | | | | | February | 0.21 | 969 | 483 | 44 | 9% |
| | | | | | | April | 0.17 | 1,069 | 558 | 77 | 14% |
| | | | | | | June | 0.13 | 987 | 672 | 49 | 7% |
| | | | | | | July | 0.08 | 981 | 637 | 74 | 12% |
| August/September | | 2,102 | 805 | 161 | 20% | August | 0.13 | 1,022 | 646 | 64 | 10% |
| | | | | | | October | 0.17 | 999 | 520 | 52 | 10% |
| November/December | | 2,054 | 627 | 173 | 28% | December | 0.13 | 960 | 472 | 33 | 7% |
| Total/weighted proportion | | 4,156 | 1,432 | 334 | NA | Total/weighted proportion | | 6,987 | 3,988 | 393 | 10% |
| 1989 | | | | | | | | | | | |
| January/February | 0.13 | 2,092 | 607 | 152 | 25% | February | 0.21 | 1,024 | 479 | 39 | 8% |
| February/March | 0.08 | 2,045 | 737 | 155 | 21% | March | | 967 | 511 | 121 | 24% |
| March/April | 0.08 | 2,156 | 928 | 213 | 23% | April | 0.17 | 1,027 | 615 | 65 | 11% |
| April/May | 0.08 | 2,082 | 1,001 | 220 | 22% | May | | 967 | 583 | 194 | 33% |
| May/June | 0.08 | 2,249 | 1,126 | 214 | 19% | June | 0.13 | 992 | 638 | 55 | 9% |
| June/July | 0.08 | 2,034 | 1,018 | 193 | 19% | July | 0.08 | 959 | 652 | 83 | 13% |
| July/August | 0.13 | 2,374 | 1,284 | 205 | 16% | August | 0.13 | 982 | 541 | 48 | 9% |
| September/October | 0.33 | 1,841 | 810 | 162 | 20% | October | 0.17 | 1,048 | 502 | 44 | 9% |
| | | | | | | December | 0.13 | 1,015 | 434 | 19 | 4% |
| Total/weighted proportion | | 16,873 | 7,511 | 1,514 | 20% | Total/weighted proportion | | 8,981 | 4,955 | 668 | 9% |

a. countryside/inland village;

b. open coastline/costal village;

c. seaside visit/resort;

d. town;

e. city;

and following this, respondents were then asked directly whether their main destination had been in a woodland or forest.

The latter approach resulted in significantly fewer respondents giving a forest or woodland as the location of their last trip, and must cast doubts on the results for 1987 which might have been high as a result of the limited number of alternatives presented to respondents. For this reason, and due to the very limited number of surveys in 1988, the figure of 20% of countryside outings being to woodland or forest recorded in 1989 is probably the only really accurate estimate of this proportion and was therefore used to estimate forest visitor numbers in all 3 years. The same change in question occurred in the Scottish sample, but the range of alternative locations already given to respondents in 1987 was much wider. This is probably why there is no significant difference between the proportion reported in 1987 and that found in 1988 and 1989.

The sensitivity of results to questionnaire design can also be seen in the results in Scotland for the two months of March and May 1989. In all the other surveys in Scotland during 1987-89, forest visit questions came after a list of several questions about leisure outings generally, required by other agencies collaborating in the survey. In these two months, however, the Forestry Commission put questions on forest visits into the survey in the absence of other leisure trip questions. This resulted in a much higher proportion of leisure outings having a forest or woodland recorded as the main destination of the outing and shows that the results were sensitive to the wording and length of the questionnaire used. Because the results for these 2 months were so different to the results recorded for other months, they were not used in the calculation of the average proportion of visits to forests for the year as a whole. None of the results for England and Wales or Scotland showed any discernable seasonal pattern in the proportion of visits made to forests supporting the assumption (discussed earlier) that it was not necessary to weight the monthly results by the total number of visits made each month to arrive at an annual estimate.

To estimate the total number of visits made to forests in these years, the number of leisure outings in Scotland and countryside outings in England and Wales were then obtained from both published sources and directly from the Countryside Commission for England and Wales and Scottish Natural Heritage (for recent survey results which have not been published). Using the average proportions presented in Table 4.2.1 the number of forest visits in 1987, 1988 and 1989, were then estimated and are shown in Table 4.2.2. The estimated number of forest visits in 1990 and 1991 were also calculated using this method, based on the total number of outings recorded in these years and the average proportion of outings to forests recorded from 1987 to 1989 in Scotland and during 1989 in England and Wales. This then enabled the results calculated in this way to be compared with the results for 1990 and 1991 calculated in the rest of the household survey.

Table 4.2.2 Estimated countryside and leisure outings and visits to forests in Great Britain 1987-91

All figures in millions

| | Year 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|
| **England and Wales** | | | | | |
| Total number of countryside outings | 1,500 | 1,800 | 1,500 | 1,600 | 1,400 |
| Total number of outings lasting more than 3 hours | 1,100 | 1,400 | 1,100 | 1,200 | 1,100 |
| Proportion of trips over 3 hours to forests | (est) 20% | (est) 20% | 20% | (est) 20% | (est) 20% |
| Total number of forest trips lasting more than 3 hours | 220 | 280 | 220 | 240 | 220 |
| **Scotland** | | | | | |
| Total number of leisure outings lasting more than 3 hours | 145 | 136 | 138 | 125 | 164 |
| Proportion of trips over 3 hours to forests | 9% | 10% | 9% | (est) 9% | (est) 9% |
| Total number of forest trips lasting more than 3 hours | 13 | 14 | 12 | 11 | 15 |
| **Great Britain** | | | | | |
| Total number of forest trips lasting more than 3 hours | 233 | 294 | 232 | 251 | 235 |

Table 4.2.3 Estimated number of visits to forests in Great Britain 1990-91

All figures in millions

| | 1990 | | | | | 1991 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | April | July | October | Total | | April | July | October | Total | |
| | | | | Weight1 | Weight2 | | | | Weight1 | Weight2 |
| Weights (system 1) | 3.00 | 3.00 | 7.00 | | | 3.00 | 3.00 | 7.00 | | |
| Weights (system 2) | 4.33 | 2.95 | 5.77 | | | 4.33 | 2.95 | 5.77 | | |
| **England and Wales** | | | | | | | | | | |
| Total number of forest visits | 22 | 26 | 19 | 277 | 282 | 21 | 20 | 15 | 228 | 237 |
| **Scotland** | | | | | | | | | | |
| Total number of forest visits | 2 | 2 | 1 | 10 | 20 | 2 | 2 | 2 | 11 | 23 |
| **Great Britain** | | | | | | | | | | |
| Total number of forest visits | 24 | 28 | 20 | 287 | 302 | 23 | 22 | 17 | 239 | 260 |
| Total number of visits more than 3 hours lon | 16 | 18 | 14 | 191 | 201 | 13 | 13 | 10 | 138 | 150 |

Note: Column July 1990 contains figure for August 1990 in Scotland

The results from each of the three surveys conducted in 1990 and 1991 are presented in Table 4.2.3. The different way in which questions about the number of forest visits made were asked has already been discussed. In interpreting the results, the most important factor to note is that the surveys counted visits of any duration rather than only visits lasting more than 3 hours away from home.

The results show annual totals estimated using both of the alternative weighting systems. The simple system (weight 1) assumed the results for April could apply to March, April and May, those for July to June, July and August, and those for October to the rest of the year, while the alternative system (weight 2) converted each of the results to average monthly results that gave them equal weight in the construction of the total. Also shown are estimates of the number of forest visits lasting more than 3 hours away from home for comparison with the results obtained earlier. These were derived from responses about the length of time on site, and the distance travelled on the visit.

The interesting result to note is how much lower the results for 1990 and 1991 were compared to those calculated for earlier years and estimated for these years using the earlier method. Forest visitor numbers ranged from 230-290 million using the earlier method but only 140-200 million (on trips lasting more than 3 hours) in 1990 and 1991. This divergence was most apparent in the results for England and Wales, the results for Scotland being roughly consistent given the accuracy of trying to estimate results for a whole year from only 3 months of data. There could have been a genuine decrease in visitor numbers due to, for example, the economic recession which started in 1990. However, this would then be expected to show up in total countryside and leisure outings as well (which it did not). It was thought therefore, that differences in survey or questionnaire design accounted for most of the difference in results between these 2 periods.

The faults with the survey design used from 1987-89 have already been discussed. The only additional doubt that must be cast over the earlier results is the factor used to get from the total number of countryside outings to the number of outings lasting more than 3 hours. The Countryside Commission survey results estimated that 75% of outings lasted more than 3 hours which is higher than the figure of 60-65% calculated in the forest visitor surveys in 1990-91. If the latter were really true, this would account for about 50% of the difference between results. However, the most likely causes for the difference can be found in the way the results were calculated in 1990-91 and the difference between the forest visit questionnaires.

Two sources of potential error in the calculation of forest visitor numbers in 1990-91 are most obvious. Firstly, the assumption that the group of most frequent visitors (8 or more times in the last 4 weeks) in the survey visited forests 11 times on average in a 4 week period is open to question. Every one visit change in this figure (eg 11 to 12 visits in the last 4 weeks) alters the final results for visits over 3 hours by about 3 million visitors. Therefore, if this category really contained very regular visitors, say 15 or 20 visits in a 4 week period, the results should be much higher (eg by 15-30 million visits for the two figures quoted above). Secondly, a potentially much larger source of error could have been introduced into the results if the weighting systems used to calculate annual results were inaccurate, or having only 3 months results was inadequate to derive an accurate estimate of the annual total. Table 4.2.1 showed the variability between monthly results over a longer period of time, and this can also be found in the monthly results of other leisure surveys, so it is possible that the months surveyed were not an accurate reflection of visitor numbers for the whole year. This seems particularly likely for the results from England and Wales in July and October 1991 which were much lower than the results obtained in the previous year although the results for April were very similar.

The main change in questionnaire design was the replacement of:

> "Have you been on one of the following types of trip"; followed by:
>
> "Was the main destination on your most recent outing in a woodland or forest" (1987-89);
>
> with:
>
> "have you been to a forest or woodland" (1990-91).

Subtly different interpretations of these phrases may have led to the lower visitor numbers recorded in 1990-91. "Have you been to ......" suggests visits made with the purpose of visiting a forest, the number of which is almost certainly likely to be lower than the number of visits made "to" all recreation sites, which also happened to be in a forest (and would therefore have been picked up using the first two phrases). Or, to put in another way, the replacement of "in" with "to" may have excluded in the latter case, large numbers of visits that were made "to" parks, gardens, lakes, footpaths etc, that were "in" (or close enough to be considered "in") woodlands. The tricky question to answer here is whether recreation on the edge of woodlands or in open spaces within woodlands should be counted as woodland visits. This can only be answered if it is known whether the visitors would still go to such sites in the absence of woodland, an answer which is not known. What is known is that a large proportion of woodland recreation takes place on the edge of woodland without visitors actually going physically into the wooded areas (see Appendix 2 for a discussion of the number of sites containing more than just woodlands as attractions, which could account for the discrepancy between these two results).

## The Distribution of Visitors Between Ownership Categories

The results discussed so far have been for visits to all forests and wooded areas, regardless of ownership. This total is important in consideration of the broad forestry policy objective to encourage recreation in forests. It is however also interesting to measure the number of visits to different ownership categories to compare use between the categories and (in the case of the Forestry Commission where earlier results are available) to see how visitor numbers have changed. At present, direct monitoring by the Forestry Commission only covers a small proportion of sites, so the household survey results are the only estimate of the number of visits to the whole of the Forestry Commission estate which can be compared to the results of earlier surveys.

Every respondent that had been to a forest on the last occasion (1988-1989) or had been at least once in the previous 4 weeks (1990-91) was asked further questions about their last forest visit. Two open-ended questions asked for the name and location of the forest. From the responses to the question about name and location of the forest an attempt was made to identify the ownership of the forest in each response. Most of the problems with these two questions were where responses were not detailed enough (eg "We went to Cannock Chase" - part of which is owned by the Forestry Commission and part by the local authority). In total, about 2,500 separate names of forests were identified over the 5 years of the survey.

Table 4.2.4 shows the proportion of visitors that were identified as having been to forests in each of the ownership categories used in the survey. Originally the 'don't know' category encompassed all the forest names that were either too general, could not be found in any map gazetteer, or could be found on maps but the ownership could not be identified. This was refined into categories of mixed ownership (where the respondent was very general and answered, for example, "The Lake District"), probably private ownership (ie the wood is definitely not in Forestry Commission, National Trust, or Woodland Trust ownership, and not likely to be owned by a local authority), and genuinely unknown replies (where either the place or woodland could not be found, more than one place could be found, or where there was a serious doubt about who owned the woodland). This process was quite difficult and took several months to complete because ownership could only be estimated by enquiries to a wide range of organisations and, in many cases, could only be estimated by a process of eliminating who did not own a particular piece of woodland.

Table 4.2.4 Estimated proportion of forest visits to different ownership categories

All figures are percentages of country totals for each year

| | Year 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|
| England and Wales | | | | |
| Forestry Commission | 39 | 34 | 23 | 19 |
| Local Authority | 5 | 8 | 16 | 18 |
| National Trust | 3 | 5 | 4 | 5 |
| Other voluntary organisation | 1 | 1 | 1 | 2 |
| Other public body | 1 | 1 | 1 | 1 |
| Private landowner | 7 | 8 | 6 | 5 |
| Water authority | NA | 2 | 1 | 1 |
| Mixed ownership | 18 | 13 | 22 | 24 |
| Probably private | 14 | 17 | 15 | 15 |
| Unknown | 13 | 11 | 10 | 10 |
| Scotland | | | | |
| Forestry Commission | 22 | 26 | 26 | 25 |
| Local authority | 17 | 28 | 32 | 33 |
| Voluntary organisation | 4 | 8 | 5 | 5 |
| Private landowner | 9 | 15 | 15 | 13 |
| Mixed ownership | 5 | 6 | 7 | 7 |
| Probably private | 7 | 8 | 4 | 10 |
| Unknown | 39 | 10 | 10 | 9 |

Table 4.2.5 Comparison of perceived ownership with actual ownership of forests visited in England and Wales during 1989

All figures are percentages of perceived ownership categories found in each of the actual ownership categories

| Perceived ownership | Actual ownership: Forestry Commission | Local authority | Voluntary organisation | National Trust | Private landowner | Water authority | Dont know |
|---|---|---|---|---|---|---|---|
| Forestry Commission | 57% | 22% | 0% | 7% | 15% | 15% | 16% |
| Local Authority | 5% | 34% | 8% | 16% | 5% | 12% | 17% |
| Joint FC/LA | 7% | 8% | 8% | 4% | 6% | 9% | 5% |
| Other public body | 3% | 3% | 8% | 2% | 6% | 12% | 2% |
| Voluntary organisation | 5% | 6% | 23% | 41% | 12% | 12% | 9% |
| Private individual | 3% | 4% | 8% | 2% | 28% | 6% | 13% |
| Private company | 2% | 1% | 15% | 2% | 3% | 6% | 4% |
| Joint public/private | 1% | 3% | 0% | 2% | 5% | 3% | 2% |
| Dont know | 17% | 17% | 31% | 22% | 19% | 24% | 32% |

The results indicated that in England and Wales, 35-40% of long visits (lasting 3 hours or more) and about 20% of visits of any duration were to Forestry Commission sites. This implied that at least 50 million visits were made annually to Forestry Commission sites in England and Wales (using the results for 1988-89 would give much higher figures). The results for Scotland showed that about 25% of long visits 25% of visits of any duration were to Forestry Commission sites, implying that a further 4-5 million visitors probably went to Forestry Commission sites there.

These results were much higher than any previously estimated for the Forestry Commission (see Table 2.2.2). This may reflect an increase in visitor numbers in recent years but almost certainly the largest part of this increase is due to the technique employed. Examination of the names of forests visited, activities undertaken on visits and methods of transport used to get to forests suggested that a large proportion of visits were to locations unlikely to be captured in site surveys (the technique which has been used in the past).

A further interesting result was found by comparing the actual ownership of forests visited to the perceived ownership (visitors were also asked to state who they thought owned the forest they had visited). Table 4.2.5 shows the results of one such comparison made for England and Wales in 1989. Respondents were most successful at identifying Forestry Commission woodlands followed by National Trust woodlands and local authority woodlands. However, some of this success might have been accidental because the Forestry Commission and local authorities were also the most commonly perceived owners of woods they did not own. Given that, at best, only just over 50% of respondents could correctly identify the owner of a woodland, this highlights one of the difficulties of marketing forest recreation.

Characteristics of forest visitors and visits

As well as collecting the basic data about forest visits on which to base estimates of the total number of forest visits, the surveys also collected a range of socio-economic information about respondents and information about visits they had made. This was used to examine the factors that might influence forest visits and for further descriptive analysis of the visits made to forest.

It was suspected that several of the socio-economic variables might be found in very different proportions in the sample of forest visitors compared to the population as a whole, indicating a degree of causality between socio-economic factors and the demand for forest recreation, and supporting the assumption made earlier that using weighted results would give more accurate estimates of visitor numbers than using unweighted results. In the following comparisons, the weighted socio-economic characteristics of both the forest visitor samples and the whole sample in each of the periods were calculated and used to compare forest visitors to the whole sample (which due to the weighting represented the population as a whole).

Table 4.2.6 shows the difference in socio-economic characteristics between forest visitors and the whole sample for 1989 and 1990/91 in both England/Wales and Scotland. Starting with the age and sex structure of the samples, the sample of forest visitors showed a demographic pattern that was significantly different to that of the

Table 4.2.6 The difference in socio–economic variables between the forest visitor sample and total sample 1989 and 1990/91

All figures are percentages within each category

| Socio–economic variable | England and Wales | | | | Scotland | | | |
|---|---|---|---|---|---|---|---|---|
| | 1989 | | 1990/91 | | 1989 | | 1990/91 | |
| | Whole sample | Forest visitors | Whole sample | Forest visitors | Whole sample | Forest visitors | Whole sample | Forest visitors |
| Age range | | | | | | | | |
| 17 and under | 5.5 | 2.5 | 4.3 | 3.2 | 5.0 | 5.7 | 4.3 | 4.9 |
| 18–24 | 12.6 | 17.5 | 12.7 | 19.9 | 16.0 | 14.5 | 15.2 | 18.6 |
| 25–34 | 18.0 | 29.4 | 18.8 | 29.0 | 17.0 | 23.8 | 18.5 | 21.5 |
| 35–44 | 17.0 | 29.8 | 16.6 | 25.8 | 16.0 | 22.6 | 16.0 | 22.3 |
| 45–54 | 14.1 | 17.5 | 14.9 | 17.3 | 15.0 | 14.1 | 14.5 | 13.1 |
| 55–64 | 12.4 | 1.6 | 11.9 | 1.8 | 13.0 | 10.1 | 13.0 | 10.4 |
| 65 and over | 20.4 | 1.7 | 20.9 | 2.9 | 18.0 | 9.2 | 18.5 | 9.3 |
| Chi–squared statistic | | 746.1 | | 902.1 | | 64.3 | | 84.2 |
| Sex | | | | | | | | |
| Male | 48.0 | 55.3 | 48.2 | 51.6 | 47.0 | 48.8 | 47.5 | 51.9 |
| Female | 52.0 | 44.7 | 51.8 | 48.4 | 53.0 | 51.2 | 52.5 | 48.1 |
| Chi–squared statistic | | 33.4 | | 10.1 | | 0.7 | | 7.0 |
| Household size | | | | | | | | |
| 1 person | – | – | – | – | 15.3 | 9.3 | 16.2 | 11.1 |
| 2 people | – | – | – | – | 30.8 | 25.8 | 32.7 | 28.9 |
| 3 people | – | – | – | – | 21.0 | 23.7 | 19.4 | 21.1 |
| 4 people | – | – | – | – | 22.2 | 29.2 | 20.7 | 25.9 |
| 5 or more people | – | – | – | – | 10.8 | 12.1 | 10.9 | 13.0 |
| Chi–squared statistic | | – | | – | | 35.4 | | 35.9 |
| Presence of children in household | | | | | | | | |
| Under 3 (EW)/under 5 (Sc) | 10.3 | 12.3 | 9.8 | 9.6 | 16.1 | 20.3 | 16.1 | 19.0 |
| 3–5 (EW)/5–9 (Sc) | 10.2 | 13.6 | 10.1 | 12.8 | 14.6 | 22.9 | 14.2 | 20.0 |
| 6–9 (EW)/10–14 (Sc) | 12.3 | 20.9 | 11.3 | 13.9 | 13.9 | 19.0 | 15.1 | 18.5 |
| 10–15 (EW)/15–17 (Sc) | 16.0 | 23.8 | 15.5 | 16.5 | 13.5 | 14.6 | 12.4 | 14.0 |
| Chi–squared statistic | | 15.1 | | 10.8 | | 7.7 | | 4.7 |
| Social class | | | | | | | | |
| A (EW) | 1.5 | 1.8 | 1.5 | 2.3 | – | – | – | – |
| B (EW)/AB (Sc) | 13.3 | 19.5 | 13.6 | 22.0 | 15.0 | 21.6 | 15.5 | 24.3 |
| C1 | 25.5 | 32.3 | 26.5 | 31.6 | 21.0 | 23.2 | 21.5 | 26.1 |
| C2 | 29.1 | 29.7 | 28.9 | 26.9 | 27.0 | 30.8 | 26.5 | 24.5 |
| DE | 30.6 | 16.7 | 29.6 | 17.2 | 37.0 | 24.4 | 36.5 | 25.1 |
| Chi–squared statistic | | 175.4 | | 250.4 | | 49.4 | | 86.8 |
| Marital status | | | | | | | | |
| Married | 62.5 | 68.6 | 61.5 | 65.9 | 60.7 | 67.6 | 60.2 | 62.7 |
| Single | 37.5 | 31.4 | 38.5 | 34.1 | 39.9 | 32.4 | 39.8 | 37.3 |
| Chi–squared statistic | | 34.9 | | 18.0 | | 12.4 | | 2.3 |
| Working status | | | | | | | | |
| Work full time | 40.0 | 52.1 | 40.0 | 47.5 | 40.2 | 46.3 | 39.6 | 48.3 |
| Work part time | 11.7 | 11.9 | 11.1 | 13.1 | 10.4 | 13.2 | 11.0 | 11.2 |
| Not working | 48.3 | 36.1 | 48.9 | 39.4 | 49.4 | 40.4 | 49.4 | 40.5 |
| Chi–squared statistic | | 104.1 | | 76.7 | | 20.5 | | 32.0 |
| House tenure | | | | | | | | |
| Owner occupier | 70.0 | 81.1 | 71.0 | 81.4 | 48.8 | 63.5 | 53.6 | 65.5 |
| Other tenure | 30.0 | 18.9 | 29.0 | 19.6 | 51.2 | 36.5 | 46.4 | 34.5 |
| Chi–squared statistic | | 92.8 | | 116.6 | | 53.8 | | 51.6 |
| Car ownership | | | | | | | | |
| Yes | 70.2 | 85.4 | 70.7 | 84.6 | – | – | – | – |
| No | 29.8 | 14.6 | 29.3 | 15.4 | – | – | – | – |
| Chi–squared statistic | | 176.1 | | 210.0 | | – | | – |
| Telephone ownership | | | | | | | | |
| Yes | 83.8 | 88.7 | 82.6 | 88.8 | – | – | – | – |
| No | 16.7 | 11.3 | 17.4 | 11.2 | – | – | – | – |
| Chi–squared statistic | | 32.9 | | 59.2 | | – | | – |

whole sample. The sample of forest visitors contained proportionately more males and people in the age ranges under 55 years old, and the sample of forest visitors in England and Wales showed a dramatic fall in participation in the 2 age ranges over 55 years old. In Scotland this also occurred but to a lesser extent, and it is difficult to explain why this difference between the two regions should occur, but one explanation could be the greater proximity to forests in Scotland.

The distribution of household sizes recorded for forest visitors in Scotland over the period was also very different to the whole sample. Small households (1-2 people) were less frequent in the forest visitor sample, while households of 3 or more people were more frequently found. This variable was not available for England and Wales, but it is unlikely that the pattern would be different south of the border.

It has been found in other studies (North West Sports Council, 1972, for example) that the presence of children can affect participation in recreation. Households with young children tend to participate less while households with older children participate much more. The results in Table 4.2.6 show that more households with children (of any age) were found in the sample of forest visitors than in the whole sample. This difference was smallest for households with very young children (under 6 years old in England/Wales and under 5 in Scotland) or older children (aged 15-17 in Scotland). The results also showed that the difference was larger for trips taken in 1989, (the longer trips) than for trips recorded in 1990/91, and that the difference was significant (at the 5% level) in England/Wales but not Scotland. It would seem therefore, that the presence of children of school age in a household might make individuals more likely to make forest visits, particularly long forest visits, than if they came from households with no children or very young children. However, this effect did not appear to be particularly strong.

The results also showed a significant difference between the social classes recorded for forest visitors and those of the general population. A much higher proportion of social classes A, B, and C1 were found in the forest visitor sample and much lower proportion of classes D and E. Social class captures a range of variables that are likely to influence recreation participation such as income, education, leisure time availability and tastes, so this result was not surprising.

The bottom part of Table 4.2.6 shows the difference in other socio-economic variables between forest visitors and the sample as a whole recorded in the survey. All these variables, with the exception of the proportion of married and unmarried visitors to forests in Scotland during 1990/91, showed significant differences between forest visitors and the general population. Married individuals are found on the whole in much greater proportions in the visitor sample than in the total sample. The other variables all reflected wealth, and individuals that were wealthier (ie were in work, owned their own homes, a car, and were on the telephone) were found in greater proportions in the sample of forest visitors, than in the sample as a whole. There was little difference between the 2 time periods, but if anything, the difference between forest visitors and the whole sample was greater with respect to the wealth indicators in the survey of longer trips (1989).

The visitors that had been to a forest either on the last occasion (1989) or in the last four weeks (1990 and 1991) were also asked more detailed questions about their last visit (see Appendix 1) in order to get additional information about the nature of visits. One of the most interesting pieces of information collected from the point of view of the resource manager is the activities undertaken on visits and these are shown in Table 4.2.7.

Visitors were not restricted to listing their main activity and on average, listed 2-3 activities in response to this question. It can be seen that most visitors went for a walk either on a trail, or on a more informal walk, many went to enjoy the opportunities to observe nature, and about one third spent some of their time just relaxing or doing nothing. Just under a quarter also went for a picnic or barbecue. This sort of information is useful because:

a. it gives some indication of the sort of facilities that visitors might require in forests to enjoy their visits; and
b. it gives further insight into the sort of individuals that make forest visits.

The results seem to indicate that a fairly low level of provision of facilities would satisfy most visitors. Waymarked trails, information points about nature spotting opportunities, picnic sites, and open areas to relax in would accommodate most visitors' needs. However, there is an identification problem with drawing these conclusions from the results. The results are not only a reflection of demand for facilities but are also dependent on the existing provision of facilities. For example, less than 10% of respondents said they had

Table 4.2.7 Activities pursued on forest visits 1989 and 1990/91

All figures are percentage of forest visitors undertaking each activity

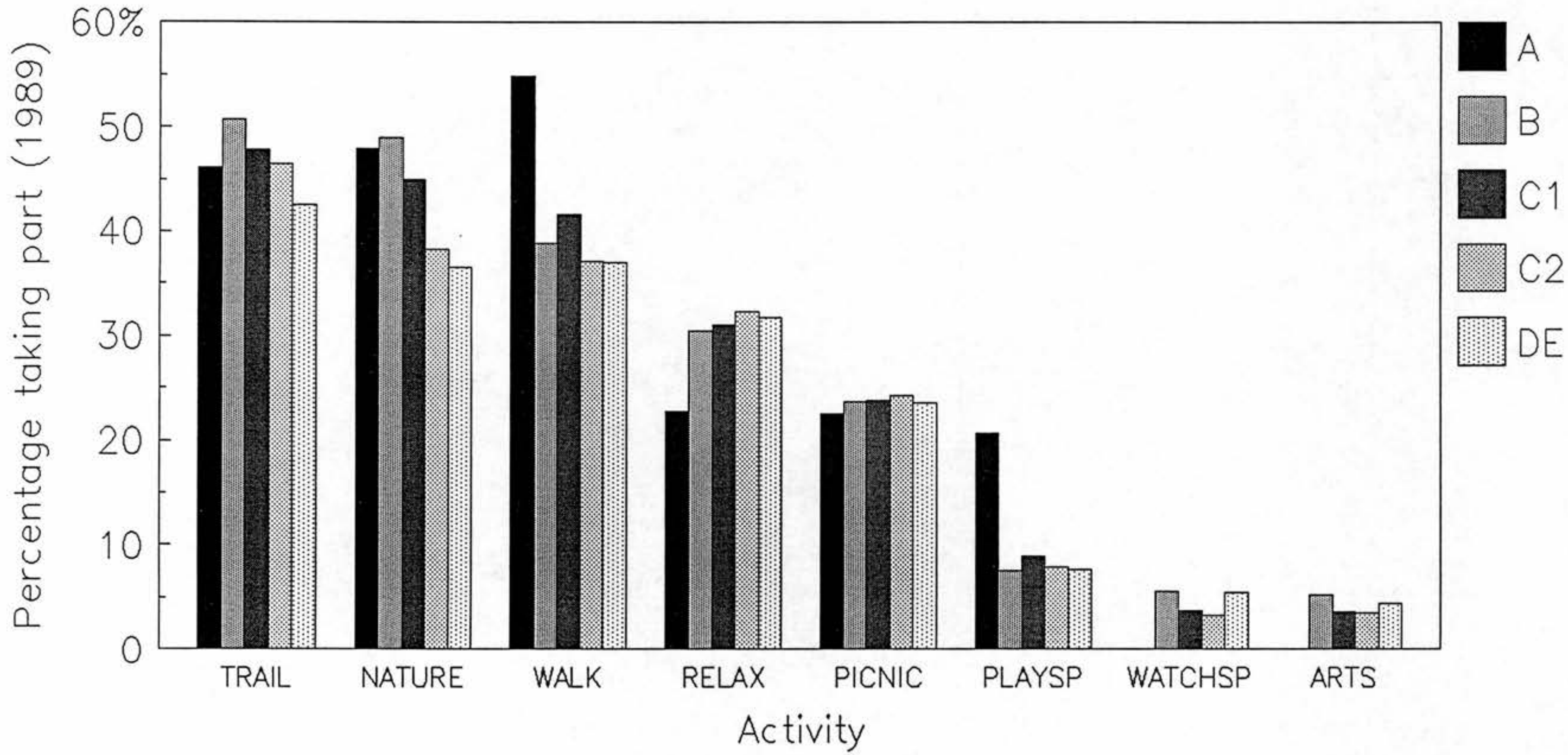
| Activity | 1989 | | | | | | 1990/91 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | Social class | | | | | Total | Social class | | | | |
| | | A | B | C1 | C2 | DE | | A | B | C1 | C2 | DE |
| England and Wales | | | | | | | | | | | | |
| Go on a walk or waymarked trail | 47.1 | 46.1 | 50.7 | 47.8 | 46.4 | 42.5 | 50.9 | 65.8 | 53.5 | 54.0 | 47.1 | 45.8 |
| Observe nature or wildlife | 42.4 | 47.9 | 49.0 | 45.0 | 38.3 | 36.6 | 38.5 | 58.5 | 39.8 | 43.7 | 34.1 | 31.2 |
| Hiking, jogging, walking the dog | 39.2 | 54.9 | 38.9 | 41.6 | 37.1 | 37.0 | 34.9 | 29.0 | 32.3 | 34.7 | 39.5 | 31.9 |
| Relax, do nothing | 31.3 | 22.7 | 30.5 | 31.0 | 32.3 | 31.7 | 29.2 | 18.4 | 27.4 | 31.3 | 29.9 | 28.1 |
| Have a picnic or barbecue | 23.8 | 22.5 | 23.6 | 23.8 | 24.2 | 23.5 | 18.4 | 13.0 | 19.3 | 19.8 | 17.2 | 17.5 |
| Play sport | 8.3 | 20.7 | 7.5 | 8.9 | 7.9 | 7.6 | 5.7 | 4.4 | 6.4 | 5.2 | 4.8 | 7.2 |
| Watch sport | 4.2 | 0.0 | 5.6 | 3.7 | 3.3 | 5.4 | 2.2 | 0.0 | 1.4 | 2.2 | 2.8 | 2.6 |
| Take part in or watch an arts event | 4.0 | 0.0 | 5.2 | 3.6 | 3.5 | 4.4 | 2.3 | 1.5 | 1.2 | 3.0 | 2.6 | 2.2 |
| Visit a vistor centre | 13.1 | 14.6 | 15.3 | 11.6 | 13.5 | 12.7 | 10.4 | 14.0 | 11.2 | 11.9 | 11.1 | 5.1 |
| Go on a forest drive | 11.0 | 11.1 | 13.1 | 11.7 | 8.0 | 12.6 | 7.9 | 6.0 | 7.8 | 8.6 | 6.8 | 8.9 |
| Buy woodland produce | 3.3 | 4.0 | 4.3 | 3.1 | 2.7 | 3.3 | 2.3 | 1.8 | 1.9 | 2.5 | 2.3 | 2.5 |
| Have a meal or refreshments | 35.0 | 39.7 | 36.7 | 30.0 | 35.7 | 41.2 | 26.3 | 30.3 | 25.5 | 28.6 | 24.8 | 24.6 |
| Use a play area | 10.6 | 6.5 | 7.4 | 9.8 | 11.9 | 13.9 | 9.4 | 9.8 | 7.9 | 8.1 | 11.4 | 10.5 |
| Use toilets | 26.3 | 45.0 | 24.8 | 22.5 | 27.6 | 31.0 | 21.8 | 17.8 | 22.7 | 23.6 | 21.1 | 18.9 |
| Other | 6.4 | 10.4 | 6.6 | 6.2 | 5.2 | 8.6 | 8.4 | 6.4 | 8.7 | 8.3 | 8.0 | 9.4 |
| Scotland | | | | | | | | | | | | |
| Go on a walk or waymarked trail | 41.7 | | 49.5 | 44.0 | 39.5 | 35.4 | 52.2 | | 56.3 | 51.5 | 53.5 | 47.7 |
| Observe nature or wildlife | 35.2 | | 45.6 | 34.2 | 36.0 | 25.8 | 45.3 | | 45.0 | 52.3 | 41.4 | 42.4 |
| Hiking, jogging, walking the dog | 24.2 | | 26.5 | 26.3 | 21.9 | 23.1 | 29.6 | | 29.2 | 30.9 | 29.0 | 29.1 |
| Relax, do nothing | 33.1 | | 34.1 | 28.4 | 32.5 | 37.3 | 33.6 | | 31.2 | 34.8 | 34.9 | 33.4 |
| Have a picnic or barbecue | 23.3 | | 25.7 | 19.3 | 22.0 | 26.4 | 18.2 | | 17.3 | 17.2 | 18.6 | 19.9 |
| Play sport | 8.4 | | 7.2 | 8.4 | 7.4 | 10.8 | 4.4 | | 3.5 | 3.6 | 6.8 | 3.9 |
| Watch sport | 4.0 | | 2.9 | 4.5 | 3.7 | 4.8 | 2.0 | | 1.0 | 2.3 | 2.3 | 2.5 |
| Take part in or watch an arts event | 2.0 | | 0.9 | 1.1 | 1.5 | 4.5 | 1.3 | | 1.1 | 1.6 | 1.3 | 1.3 |
| Visit a vistor centre | 16.8 | | 16.3 | 13.1 | 19.0 | 18.1 | 12.0 | | 13.6 | 11.2 | 16.0 | 7.4 |
| Go on a forest drive | 4.4 | | 7.8 | 5.0 | 2.0 | 3.8 | 4.3 | | 4.7 | 4.3 | 3.2 | 4.8 |
| Buy woodland produce | 2.5 | | 4.6 | 1.3 | 3.0 | 1.2 | 3.0 | | 5.1 | 3.7 | 2.0 | 1.2 |
| Have a meal or refreshments | 25.4 | | 29.4 | 21.2 | 27.3 | 23.3 | 19.4 | | 21.0 | 18.5 | 19.8 | 18.2 |
| Use a play area | 18.9 | | 20.0 | 14.5 | 21.5 | 18.7 | 14.5 | | 8.6 | 12.8 | 19.7 | 16.9 |
| Use toilets | 26.7 | | 24.8 | 24.3 | 28.3 | 28.5 | 19.7 | | 16.6 | 21.6 | 22.6 | 17.8 |
| Other | 3.3 | | 0.0 | 5.4 | 3.0 | 4.5 | 2.2 | | 0.4 | 3.5 | 2.7 | 2.1 |

played sport on their last visit, this may mean that only 10% of forest visitors want to play sport, but it could mean that only 10% of forest visitors could find forests with facilities for sports (the main sports pursued in forests are shooting, stalking, hunting, orienteering, running, cycling and rally driving). Other visitors may have wished to play sport but been unable to find facilities, and others that did not make visits might have done so if facilities had been available.

This problem can be overcome by asking people what facilities they would like to see, which is an approach that has been taken by organisations such as the Sports Council (eg North-West Sports Council, 1972) to examine future participation in different sports. However, these sorts of questions often suffer from the problem of respondents expressing desires that they are unlikely to meet in reality (for example, more glamorous activities are often reported in these types of survey such as diving, water-skiing, gliding and parachuting), so this line of questioning was not pursued in the enquiry. Because of this, these results must be treated with some caution. A lack of provision of some types of facilities may be reflected in individuals travelling further to undertake less common activities reported in the survey, and this is investigated further in the discussion of travel distances below.

Comparison of the proportion of visitors in different social groups that took part in different activities (see Figure 4.2.1).showed that some pursuits such as walking, playing sport and observing nature were more popular with the higher social groups while others such as relaxing, sunbathing and having a picnic were popular with lower social groups. These results were interesting because they were similar to

Figure 4 . 2 . 1 Proportion of visitors in different social classes that took part in activities



results obtained in a survey of attitudes to forestry by Lee (1991). The research by Lee investigated the motivation behind forest visits and found four district types of visitor:

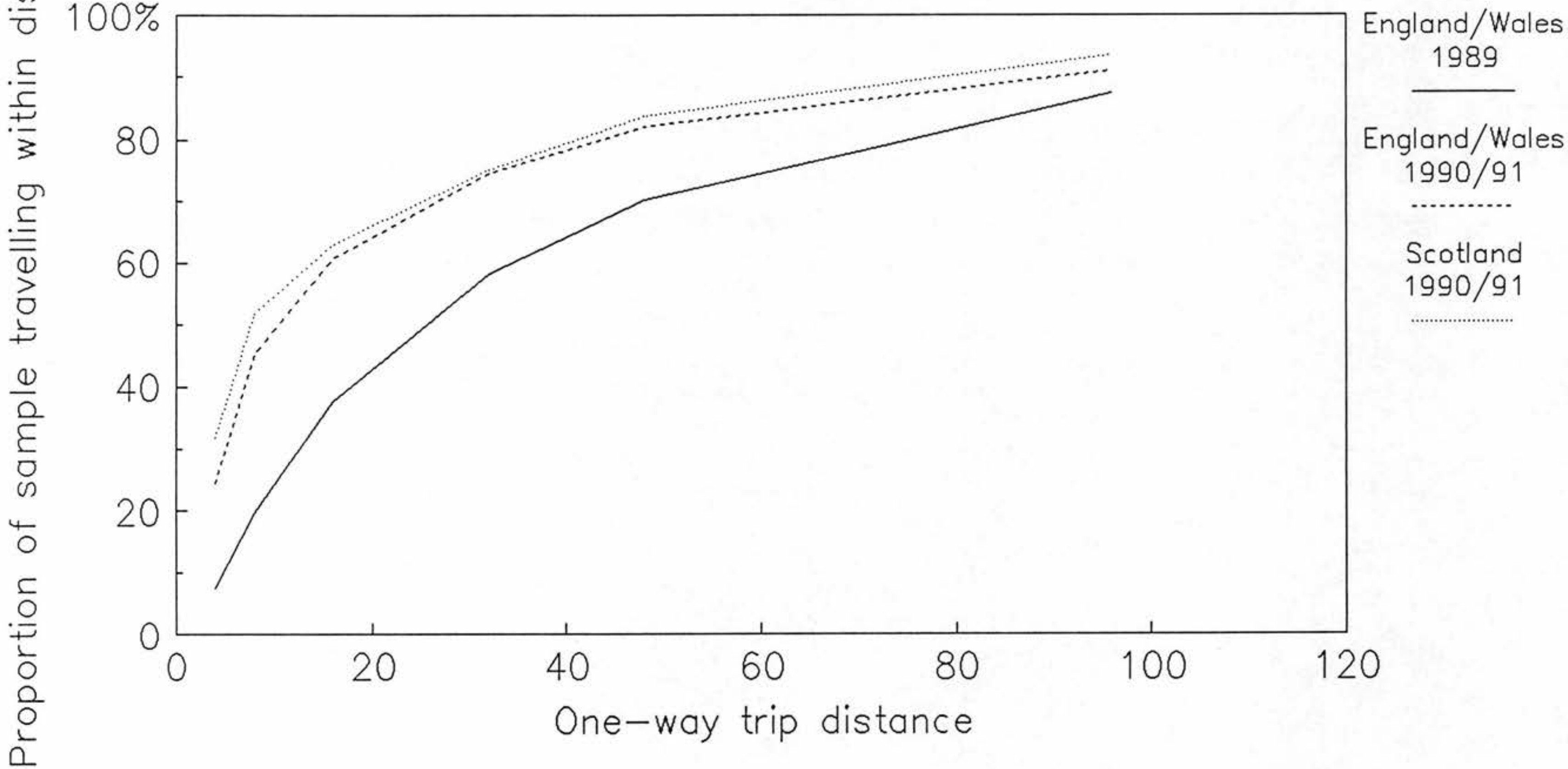
1. The forest enthusiast - the forest visitor who is very keen on the forest environment for his or her day out.
2. The social visitor - the visitor that is going for a social day out and would be as happy visiting a village or the beach as a forest.
3. The sports enthusiast - the forest visitor that finds the forest provides the right kind of environment for his or her chosen sport.
4. The dog walker.

Higher social groups appeared to favour walking and observing nature, which would be broadly analogous to the forest enthusiast, while lower social groups favoured relaxing and having a picnic, which would be similar to the social visitor. The results therefore seemed to concur with those obtained by Lee.

Visitors to forests during 1990 and 1991 and some of the visitors to forests in England during 1989 were also asked how far they had travelled (total round-trip distance) to make their forest visit. The distances recorded are shown in Figure 4.2.2 (converted to one-way distance in km).

The first point to note is that visitors to forests in England and Wales during 1989 tended to travel further than the others. This is not surprising, because the sample in 1989 restricted forest visits to

Figure 4.2.2 A comparison between travel distances in England/Wales and Scotland, and on trips of different durations



visits of over 3 hours total duration (including travel time), so amongst all short distance visitors only those that had stayed a relatively long time at sites were counted in the sample. From the results in 1990/91 it can be seen that about half of all visitors travelled to forests within 8 km of their starting point, a further 30% travelled to forests 8-50 km away, 10% to forests 50-100 km away and the remaining 10% to forests more than 100 km away. It is interesting to observe that the results for Scotland showed marginally higher travel distances than for England and Wales, although Scotland has a much higher proportion of land covered with forests. The results did not show any seasonal pattern of differences in travel distance.

The information collected on distance travelled by forest visitors was crucial for the analysis of supply and demand for forest recreation (as will be shown later in this chapter). Economic theory suggests that individuals deciding to make a forest visit would (all other things being equal) always choose to visit the closest available site. In doing so, they would maximise the difference between the utility of making the visit and the disutility of spending time and money on making the visit. The number of visits made would be the number up until the marginal benefit of an additional visit was no longer greater than the marginal cost of visiting the closest site. If this was a realistic model of the demand for forest visits then the number of visits at each distance would measure perfectly the effect of distance (cost or price) on demand after taking into account the distances to the nearest forest for each starting location, and the proportion of visitors in the sample at each of these starting locations. However, while the rationality implicit in theory may work for many products there are several problems with applying it to recreational choice:

1. Forests and other recreational sites are not homogeneous, and differ in characteristics that appeal to different visitors. This would have to be taken into account in such a way that visitors would be assumed to always visit the closest site with the desirable attributes they seek.
2. There is imperfect information about sites, so visitors do not always know about the closest forest.
3. If the above theory was correct, then visitors would always go to the same site, which may lead to undesirable attributes (eg familiarity) after a while. Furthermore, all visitors from densely populated starting points would tend to go to the same site which would lead to congestion, which could be a further undesirable attribute.

4. The utility derived from travelling to a site is also an unknown variable which could affect visitation patterns.

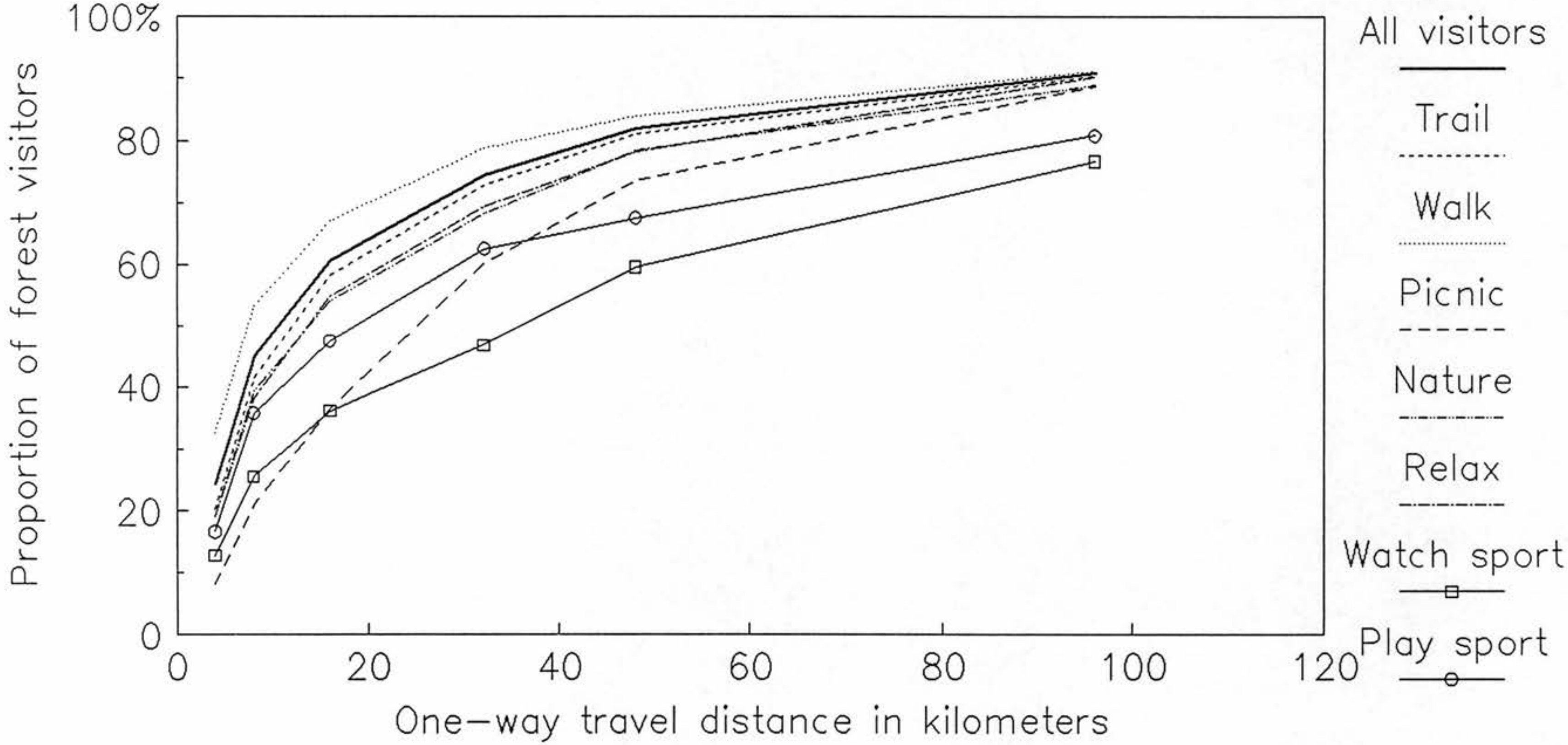
5. It is observed that visitors often do go to sites that are further away than similar alternatives, even when the alternatives are well known. Experience does not therefore bear out this theory.

It may be more realistic to consider recreation choice as a random event, where individuals are faced with a set of known sites offering them positive net utility and unknown sites that they might find along the way. On each trip they choose one of these sites either by chance or on the basis of non-economic information, but do not act as rational cost minimising individuals. In this case, those that end up travelling further do so as a result of having more utility from visiting forests and therefore having a wider set of alternatives providing them with some positive net utility from which to choose.

To test the effect of distance on demand, it is necessary to identify the underlying demand curve for visits at different distances and, as has already been discussed, one problem with trying to identify this from the data is the unequal distribution of forests about the different starting locations recorded in the sample. This is a similar identification problem to that reported about the information on activities, in that distances travelled by respondents may reflect the availability of forests about their starting locations as well as indicating how far they are prepared to travel to make a visit. However, this could be tested by examining the correlation between travel distances reported, and the supply of forests at different locations. If the supply of forests has significantly affected the travel distances reported in the survey, then it would be expected that travel distance would be negatively correlated with the supply of forests at each location and there would be some bias from using these figures as an indication of the effect of distance on participation. These issues were investigated in the analysis of forest supply and are discussed later in this chapter.

Figure 4.2.3 shows the proportion of visitors travelling different distances to undertake various activities recorded in the survey. It can be seen that visitors going to play or watch sport and, to a lesser extent, to have picnics, generally tended to travel further than other visitors. This could indicate that those activities have been recorded as taking place less frequently than individuals would have desired due to a lack of facilities close to where they live as was discussed

**Figure 4.2.3 Proportion of forest visits made within particular one-way travel distances**




Visits of all length (1990–91)

above. Alternatively this result could also occur if there is correlation between the desire to undertake a particular activity and the distance travelled to a site (for example, individuals may not want to have a picnic unless they have travelled quite a distance, so the results may reflect this correlation rather than reflect a lack of provision of facilities close to home). This uncertainly meant it was difficult to estimate how much the lack of facilities resulted in lower participation than would have been desired by respondents, but it seemed to indicate that a lack of facilities for these sorts of activities could have affected participation by some potential visitors.

Forest visitors were also asked how much they personally spent on their forest visit on travel, parking, refreshments and other purchases such as gifts (see Table 4.2.8). This information showed what the main items of expenditure on visits to forests were, what the total cost of making forest trips was, and can be used to estimate how much money forest recreation puts into the rural economy. The information on petrol costs and fares can also, combined with the information on distance travelled, be used to estimate the variable cost of visiting forests.

In all cases, the travel cost (petrol plus fares) was the largest item of expenditure on forest visits. This amounted to just over £5 in England and Wales during 1989, and £4 in England and Wales or £3 in Scotland in 1990/91, but the fact that less than half of the respondents said they had spent nothing implied that this might have been overestimated by respondents giving answers for the car-load (ie with an average party size greater than 2, it would be expected that

| Table 4.2.8 Expenditure on forest visits | | | | | |
|---|---|---|---|---|---|
| Item of expenditure | Average expenditure | Proportion of respondents | | | |
| | | Spending nothing | Spending up to £5 | Spending £5–10 | Spending over £10 |
| England/Wales 1989 | | | | | |
| Petrol | £4.41 | 36.4 | 33.8 | 13.7 | 9.5 |
| Fares | £0.89 | 83.3 | 3.8 | 0.7 | 1.9 |
| Admission & parking | £1.45 | 67.7 | 17.1 | 2.6 | 3.1 |
| Food and drink | £4.80 | 42.6 | 28.0 | 10.7 | 11.3 |
| Other items eg. gifts | £2.36 | 71.7 | 10.3 | 3.7 | 4.7 |
| England/Wales 1990/91 | | | | | |
| Petrol | £3.21 | 47.9 | 31.8 | 7.9 | 6.7 |
| Fares | £0.75 | 85.2 | 2.6 | 1.1 | 1.5 |
| Admission & parking | £0.74 | 78.9 | 9.9 | 1.6 | 1.0 |
| Food and drink | £2.87 | 59.0 | 22.9 | 5.9 | 6.5 |
| Other items eg. gifts | £1.23 | 80.2 | 6.7 | 2.6 | 2.8 |
| Scotland 1990/91 | | | | | |
| Petrol | £2.78 | 46.9 | 36.1 | 11.0 | 5.2 |
| Fares | £0.29 | 93.6 | 3.5 | 0.6 | 0.7 |
| Admission & parking | £0.44 | 89.3 | 6.7 | 2.0 | 0.6 |
| Food and drink | £2.28 | 62.6 | 23.8 | 8.0 | 4.6 |
| Other items eg. gifts | £0.71 | 87.0 | 8.7 | 0.7 | 2.0 |

Notes: Average expenditure calculated assuming mid–points in each of the ranges and £15 in the highest category, and excluding dont know responses. Proportions do not add up to 100 because of dont know responses.

Table 4.2.9 Travel cost of making forest visits

All figures in pence per mile

| Roundtrip distance travelled (in miles) | England/Wales 1989 | England/Wales 1990/91 | Scotland 1990/91 |
|---|---|---|---|
| Under 5 | 53 | 49 | 32 |
| 5–10 | 23 | 19 | 24 |
| 11–20 | 16 | 16 | 15 |
| 21–40 | 11 | 10 | 12 |
| 41–60 | 7 | 9 | 7 |
| 61–120 | 8 | 9 | 7 |
| over 120 | 11 | 11 | 10 |
| All distances | 16 | 22 | 20 |

Notes: Travel cost calculated assuming mid–points in each of the expenditure ranges and £15 in the highest range, excluding dont know responses, and 140 miles travelled in the highest distance category.

more than half the respondents would have personally spent nothing on petrol). The difference between 1989 and 1990/91 can be explained by the fact that only longer visits were examined in 1989. Purchases of food and drink made up the next largest item of expenditure (£2-5) followed by purchases of other items on the visit such as gifts (£1-2). The smallest item of expenditure was on admission and parking charges for the visit, which on average was about £1.50 for the visits reported in 1989 and about 45-75p for visits during 1990/91. Only 6% of respondents in 1989, and 3% in 1990/91, claimed to have spent more than £5 on admission and parking, and it is likely that in most of these cases, this was for entry to sites providing much more than just forests (eg country houses, formal gardens, sporting events). Charges for entry to forests would therefore, seem to be low, which is to be expected considering how difficult and expensive it would be to collect such charges.

Total expenditure on forest visits was £14 in 1989, and £7-9 in 1990/91. The question specifically asked for personal rather than group expenditure, so this is the average amount that each individual spent on such visits (assuming that the amounts reported by those that paid for others on the visit cancel out the amounts reported by those that were paid for by others). It did not include any amounts for depreciation of vehicles, outdoor recreation equipment or sporting goods used on the visit. A question often asked by policymakers is how much money countryside recreation brings in to rural economies. While this was not examined thoroughly in the survey, an estimate of this can be made. Assuming that all expenses except travel costs (ie petrol and fares) were incurred at or close to the sites visited, and that 95% of visits were made outside towns or cities*, it can be estimated that about 50-60% of expenditure or £3.50-£4.50 per visit was spent in the rural economy on each visit (giving a total of £700m-£1,000m per year in total for forest visits).

Table 4.2.9 shows the travel cost calculated from the responses to questions about expenditure on petrol and fares and distance travelled. All of this information was grouped into quite wide bands, so the results are probably not very precise. This grouping probably also accounts for why the travel cost is much higher in the shorter distance bands. However, the results indicate that respondents' perceptions of travel costs were that they are about 15-20 pence per mile, which is a similar figure to results obtained in other surveys (eg Benson and Willis, 1992).

Forest visitors were asked how they chose the forest they visited, to see what sources of information visitors use when deciding where to go for a visit. This information is useful because the provision of information is another area over which the resource manager has control, and knowing what sources of information are most commonly used by visitors, can help in the promotion and marketing of forest recreation opportunities. The responses to this question are shown in Table 4.2.10.

It can be seen that the vast majority of visitors chose to go to a forest because they had been there before. So, most visitors to

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*The survey in 1989 indicated that less than 2% of trips were made to woods in towns and cities, and although looking at trips of all length is likely to increase the proportion in urban areas, it is likely that this proportion will not be large.

Table 4.2.10 Sources of information used by forest visitors in choosing a site to visit

All figures are percentages

| Source of information | England/Wales | | Scotland | |
|---|---|---|---|---|
| | 1989 | 1990/91 | 1989 | 1990/91 |
| Visitor had been before | 56.9 | 65.6 | 66.4 | 73.8 |
| Found by chance | 5.1 | 4.5 | 3.8 | 3.3 |
| Followed signposts | 2.4 | 1.8 | 2.3 | 1.9 |
| Found on map | 5.5 | 3.4 | 2.8 | 2.8 |
| Used Tourist Info Centre | 1.8 | 1.9 | 1.7 | 1.4 |
| From leaflet or advert | 3.7 | 2.3 | 2.9 | 2.1 |
| Personal recommendation | 13.9 | 11.8 | 13.0 | 10.6 |
| Another forest | 0.5 | 0.4 | 0.1 | 0.4 |
| Other | 6.9 | 6.1 | 4.4 | 2.7 |
| Cant remember | 3.4 | 2.1 | 2.5 | 1.1 |

Table 4.2.11 Length of time on site on forest visits

All figures are percentages except average length of stay

| Length of time on site | England/Wales | | Scotland | |
|---|---|---|---|---|
| | 1989 | 1990/91 | 1989 | 1990/91 |
| Under 1 hour | 5.7 | 21.8 | 9.0 | 21.0 |
| 1–2 hours | 17.0 | 24.5 | 23.0 | 29.1 |
| 2–3 hours | 25.2 | 20.3 | 21.1 | 23.0 |
| 3–4 hours | 15.5 | 9.5 | 18.3 | 10.4 |
| 4–5 hours | 9.9 | 5.2 | 9.5 | 4.3 |
| over 5 hours | 25.5 | 17.5 | 16.7 | 11.8 |
| Average length of stay in hours | 3.3 | 2.5 | 3.0 | 2.3 |

forests are repeat visitors. Of the new visitors, just under half decided to go to the forest on the personal recommendation of someone else (who had presumably been there before), making this the most important way new visitors are attracted to the forest. Following this, the next most important ways visitors found forests were: by chance; from maps; from leaflets and from signposting (in that order). Few visitors found out about new forests to visit from Tourist Information Centres, or while visiting other forests.

The correlation between distance to the site and how the site was chosen was also examined. It was found that information from maps, advertising and leaflets and personal recommendation increased in importance for longer visits as did the number of visitors arriving at a site by chance. In contrast, the likelihood of a visitor choosing a site because they had been there before fell substantially from 80-90% for visits to sites less than 5 miles away to 40-50% for visits to sites over 120 miles away (round trip distances). However, for even very long trips, personal experience was still the most common way in which sites were found, with 20% of trips being generated because of personal recommendation in addition to the 40-50% recorded as repeat visits.

A further piece of information collected in the survey was the length of time respondents spent at the site. Results were quite similar for Scotland and England/Wales but were very different between 1989 and 1990/91 (see Table 4.2.11). This was again due to the fact that only visits over 3 hours in total duration were counted in 1989. Colenutt and Sidaway (1973) reported some positive correlation between distance travelled and length of time spent at a site, which was also found in the results of this survey. From the results of the 1990/91 surveys, it can be seen that the average length of time spent at a site was about 2½ hours (slightly less in Scotland), with about half of all visitors reporting a stay of up to 2 hours long. This information is potentially useful because it allows the visitor number results to be converted to visitor hours (as in Collings, 1977) or some other measure of a standard visit corrected for length of stay (for example, in the USA, the Forest Service standardises all visits to a Recreation Day Visit or RDV of 12 hours on site).

Finally, respondents in 1990-91, and some of the respondents in England and Wales during 1989 were also asked how many people were in their party on the forest visit. The number of adults and children recorded in the survey is shown in Table 4.2.12. The average size party was about 3 adults and 1 child per visit. This information can be used to estimate the number of children making forest visits (the visitor numbers recorded earlier were for adults only). On average, there were 0.4-0.5 children's visits to woodlands for every adult visit (excluding children that visit on their own), so the figures presented earlier could be increased by 40-50% to arrive at a figure for total visitor numbers of all ages. These results are again similar to those reported in other surveys such as Mutch (1968), Colenutt and Sidaway, (1973), Willis *et al* (1988) and Benson and Willis (1989).

Conclusions

This section has shown how estimates of the number of visitors to forests from 1987-91 were calculated. It has reported on the main characteristics of forest visitors and given detailed information about

Table 4.2.12 Average party size on forest visits

All figures are percentages except average party size and ratio of children to adults

| Party size | England and Wales | | | | Scotland | |
|---|---|---|---|---|---|---|
| | 1989 | | 1990/91 | | 1990/91 | |
| | Adults | Children | Adults | Children | Adults | Children |
| None | | 52.1 | | 57.3 | | 55.0 |
| 1 | 8.0 | 13.9 | 14.4 | 13.6 | 20.1 | 13.3 |
| 2 | 52.8 | 18.3 | 52.5 | 15.7 | 53.1 | 18.3 |
| 3 | 13.1 | 5.7 | 11.5 | 6.3 | 10.1 | 7.5 |
| 4 | 13.6 | 2.8 | 11.2 | 2.8 | 9.4 | 2.2 |
| 5 | 2.5 | 1.4 | 2.1 | 1.3 | 2.0 | 1.3 |
| 6–10 | 3.8 | 1.5 | 3.4 | 1.4 | 3.3 | 1.1 |
| over 10 | 6.2 | 4.3 | 4.9 | 1.7 | 1.8 | 1.2 |
| Average party size | 3.2 | 1.5 | 3.0 | 1.1 | 2.5 | 1.1 |
| Children per adult | | 0.5 | | 0.4 | | 0.4 |

Note: Average party size calculated assuming 12 persons in the over 10 category.

the sorts of visits made. It has also discussed some of the uncertainties in the results, many of which are common when trying to use household surveys to estimate recreation demand.

The results from 1987-89 indicated that there were about 230-290 million visits to forests each year on trips lasting more than 3 hours away from home. Figures obtained using a different questionnaire in 1990 and 1991 indicated a much lower level of visitor numbers of 220-290 million on visits of any length, or 140-190 million visits of 3 or more hours duration. However, these results were only based on 3 months' survey results and could therefore be inaccurate. It is suspected that this difference can be explained by changes to the questionnaire and that visitor numbers did not actually fall by 100 million between these two periods. It is also thought possible that the results for 1990 and 1991 excluded some visits not made deliberately to woodlands but to other sites in wooded locations (which would have been captured in the earlier results).

By asking respondents the name and location of the last woodland they visited, it was estimated that at least 50 million visits are made to the Forestry Commission estate each year. This is higher than previous estimates of visitor numbers which have been obtained from site surveys or opinions of forest managers (see Chapter 2). The estimated number of all forest visits is also higher than the results obtained in other household leisure and countryside recreation surveys that have enquired about forest visits (although it must be borne in mind that these surveys were not designed specifically to estimate forest visitor numbers and could therefore be quite inaccurate).

Analysis of the socio-economic characteristics of forest visitors has shown that they tend to be young families with children, in higher social classes and wealthy. Men also tend to be more likely to visit forests than women. The difference in socio-economic characteristics between forest visitors and the population as a whole (as measured by the whole sample) would therefore, suggest correlation between the probability of visiting and age, sex, social class, presence of children in the household, and wealth.

Visitors pursued a range of activities on visits and most visits lasted about 2½ hours on site. One child visited for every two to three adults on average indicating that total visitor numbers of both adults and children were about 50% higher than those reported above. Most visits were also to sites fairly close to home, and about 60-70% of visits were repeat visits. However, very few visitors could accurately state who owned the forest they visited. The information collected on distance travelled to sites showed that visitors going for picnics or sport in forests tended to travel further than other visitors, but it was not possible to determine whether this was a supply or demand issue.

Postscript

The variability in household survey results shown in the difference between results obtained in 1987-89 and 1990-91 and between the results from different recreation surveys generally prompted all the leading countryside and leisure agencies to collaborate in visitor surveys in the future. Collaborative surveys in 1992 and 1993 were carried out under the auspices of the Countryside Recreation Network and are currently under way for 1994.

The results obtained from the pilot survey in 1992 indicated a far lower number of countryside outings than had been recorded earlier, and a lower number of forest visits than estimated for 1990 and 1991. However, this was only a pilot survey, which did not cover the whole of the year, and more detailed analysis of the results indicated several deficiencies in the survey and questionnaire design (particularly with respect to forest visits). These have now been rectified in the surveys from 1993 onwards, and preliminary analysis of the results from the 1993 survey indicate numbers of visitors to forests similar to those obtained in 1990 and 1991, although with a much larger proportion of visits under 3 hours long.

4.3 THE SUPPLY OF FORESTS FOR RECREATION

The two previous sections of this chapter examined the data collected in household surveys, and discussed how this could be used to estimate forest visitor numbers. This section turns to the question of how the supply of forests for recreation might be estimated. It is important to know what the supply of forests for recreation is to determine where demand might be currently limited by the availability of forests for recreation, and to examine how the supply of forests might affect recreation participation (this is done in the next section).

Three sources of data on forests were examined: the Census of Woodlands (Locke, 1987) satellite data on forests held within the Department of Environment's Countryside Information System (CIS), and the databases of forest recreation sites compiled as part of the household survey. The accuracy and suitability of each of these data sources is discussed below along with the problem of aggregating forests into a single spatially referenced measure of supply. Following this, each of the sources are then used to calculate different measures of the supply of forests for recreation across Great Britain and the differences between each of them are examined. Finally, conclusions are drawn as to the supply of forests for recreation at a range of locations throughout Britain.

Sources of data on woodland supply in Great Britain

Three sources of data on woodland were examined in this research: the 1980 Census of Woodlands; satellite data on forestry held in the CIS and the databases of forest recreation sites compiled as part of the household survey. However, before examining the three data sources on woodland supply, it is worthwhile considering the criteria against which they should be judged. The following three criteria were chosen as being most relevant to this exercise:

a. The level of detail at which supply information is held. This is quite important to the calculation of aggregate forest recreation supply because earlier results have already shown that forest visits tend to be made over quite short distances. While it would also be desirable to have detailed information about other factors such as the age and species composition of woodlands and any provision of facilities for recreation, this is unlikely to be available from any of the data sources.

b. The accuracy of data. This is also important, and it is obviously best to have the most accurate and up-to-date figures as possible. Each of the data sources used very different techniques to collect and measure forest data which resulted in possible variation in accuracy between the three.

c. The third criterion against which the data sources must be appraised is the appropriateness of the data collected to the task of measuring woodland used specifically for recreation. This covers two main factors which must be considered. Firstly, there is the question of the correct measure to use. Most recreation visits tend to be of quite short duration so visitors often only encounter quite small areas of woodland. In some large woodlands there will be many of these small areas so that in effect the whole of the woodland is used for recreation, however in others large areas of woodland are far from the places where visitors arrive and are hardly ever used for recreation. A further point to consider is that recreation often takes place in areas of open space within and adjacent to woodlands, particularly in sparsely wooded locations such as country parks, woodland gardens and other areas of parkland that were identified in the survey as woodlands visited. The problem facing anyone trying to measure this is exactly how much of a woodland and adjacent land should be counted as the measure of recreational area (a further extension of this is whether it should be area at all that is measured or an alternative indicator such as number and location of facilities or number of sites, a point which is considered further later on).

The second factor which must be considered is the question of which areas of woodland should be included in the measure. Great variation in the supply of recreation services from similarly sized woodlands can occur because of differing levels of accessibility due to for example, the attitudes to access on the part of the owner and the provision of facilities for access and recreation. The data used to measure supply were all area measures because in general, larger woodlands can accommodate more visitors than smaller woodlands particularly where they are heavily used, and congestion could detract from the enjoyment of a visit. However, where more facilities are provided, and the owner accepts or positively encourages recreation, it is likely that the recreation services or opportunities supplied are greater than where the opposite is true (a factor which could not be identified in any of the data sources).

By examining the three available data sources against each of these criteria, it is possible to consider how well each of them might perform as indicators of the supply of woodland for recreation, and this is done below.

Table 4.3.1 shows estimates of woodland area obtained from all three sources. Starting with the Census of Woodland, the table shows the area of forest cover as at 31 March 1991 in Great Britain, derived from the surveys carried out in 1979-82 (Locke, 1987) and updated with information collected annually about the area of trees newly planted receiving Forestry Commission grant aid (it is assumed that only a small area of woodland is planted without grant aid from the Forestry Commission).

Woodland, for the purposes of these figures was defined as:

> "an area of woody growth greater than 0.25 ha in area and at least 20 m wide." (Locke, 1987, p 105.)

It was also defined as having a stocking density of greater than 20% tree cover, although this can be difficult to determine. The category of other woodland consists of areas where timber production is not a main objective and it includes areas managed chiefly for amenity and public recreation.

Table 4.3.1 Estimates of woodland cover in 1991

All figures are in thousand hectares except estimates of non-woodland trees which are in millions of trees.

| Data source and woodland type | England | Wales | Scotland | Great Britain |
|---|---|---|---|---|
| 1980 Census (updated to 1991) | | | | |
| Forestry Commission | 217 | 126 | 516 | 859 |
| Private sector | 639 | 109 | 533 | 1,281 |
| Other woodland | 102 | 12 | 82 | 196 |
| Total woodland | 958 | 247 | 1,131 | 2,336 |
| *Isolated trees* | *13.3* | *2.0* | *1.7* | *17.0* |
| *Clumps* | *23.5* | *3.9* | *5.3* | *32.7* |
| *Linear features* | *24.6* | *6.6* | *6.0* | *37.2* |
| Estimated area of non-woodland trees | 138 | 30 | 32 | 200 |
| Total woodland plus non-woodland trees | 1,096 | 277 | 1,163 | 2,536 |
| ITE Satellite land cover data | | | | |
| Deciduous woodland | 721 | 251 | 172 | 1,144 |
| Evergreen woodland | 209 | 87 | 456 | 752 |
| Total woodland | 930 | 338 | 628 | 1,896 |
| Forest recreation databases derived from household surveys | | | | |
| Forestry Commission | 135 | 31 | 132 | 297 |
| Local authorities | 24 | 4 | NA | NA |
| National Trust | 23 | 1 | NA | NA |
| Other public bodies | 3 | 0 | NA | NA |
| Voluntary organisations | 2 | 0 | NA | NA |
| Water authorities | 2 | 0 | NA | NA |
| Private | 21 | 1 | NA | NA |
| Probably private | 22 | 1 | NA | NA |
| Dont know owner | 5 | 0 | NA | NA |
| Total recreational woodland | 235 | 38 | 132 | 297 |

The census also examined non-woodland trees, which it split into three categories: isolated trees; clumps; and linear features. The number of non-woodland trees recorded is shown in Table 4.3.1. Non-woodland trees were defined as having a diameter at breast height of greater than 7 cm, and these figures have not been updated to 1991. In addition to the above a further 26 million trees were estimated to be either less than 7 cm DBH or dead or dying. It is difficult to make an area estimate for non-woodland trees, but it was calculated that the area of clumps and linear features made up approximately 200 thousand hectares of trees in addition to the areas reported as woodland.

In terms of the above criteria for assessing this source of data, the census data is probably the poorest source. Information is only available to a county or regional level, so it is not possible to get any great detail about the location of woodland. The Census involved a complete enumeration of woodland owned by the Forestry Commission or in a grant scheme at the time and a sample survey of other woodland and non-woodland trees so it was quite accurate when it was done. However, it is now more than 10 years out of date, and can only be updated in a fairly crude way by increasing the area of woodland in counties on the basis of data available on new planting at a county level. The Census figures include all woodland, so they include large areas that are distant to point of entry and areas where recreation is discouraged. The figures do include some open ground within woodland which might be used for recreation because the minimum stocking density in the definition of a woodland was only 20%. On the whole however, the census is likely to have included large areas of woodland that have little or no recreation potential but at the same time missed other areas of sparsely wooded land and land adjacent to forests that should be included in the supply measure, the net effect of which is to overestimate the supply of woodland for recreation.

The second source of data is the satellite land cover data now available for the whole of Great Britain and stored on the Department of Environment's Countryside Information System (CIS). This data is held at a resolution of 1 km squares, and has been digitised from data held at 25 m x 25 m resolution collected by the Institute of Terrestrial Ecology over the last 5 years. Of the 17 land cover categories identified within the CIS, two woodland types are identified: deciduous woodland and evergreen woodland.

This data is a little better as a measure of woodland supply for recreation. The data is held for every kilometre grid-square in Britain, so it is much easier to get detailed information about the location of woodland. It is also much more recent than the information obtained from the census. There is however considerable doubt about the accuracy of the data thought to be due to poor interpretation of the satellite photographs (this is discussed later in the comparison between the three sources). In addition to this, the information is still a measure of total woodland area and does not take into account the accessibility of different areas of woodland, the amount of woodland that is remote from points of entry or the amount of open space associated with woodlands. In this respect, it is also likely, therefore, to present an overestimate of the supply of woodland for recreation.

The amount of woodland identified in the forest recreation databases constructed from the household surveys is shown at the bottom of

Table 4.3.1. A complete discussion of the construction of the forest recreation databases from the responses to the household survey is given in Appendix 2. Each of the woodland blocks held on these databases had an accurate grid reference, and the area information was taken from Ordnance Survey maps and is therefore quite up to date. Woodland where recreation facilities can be found (in the case of the Forestry Commission) or were used by visitors or advertised in some way (other woodlands) were only included on the database so they contain a more accurate picture of the appropriate area of woodland that is used for recreation compared to the other data sources. The problem still remained of identifying and measuring open space associated with woodland, but by including areas of parkland as well as woodland and by including areas of adjacent land within ownerships, it was felt that a better idea of the true area of wooded land used for recreation could be obtained from this source. There were two main problems with the data set however:

a. Apart from the fact that it contained no data for Scotland except Forestry Commission data, it was also not known whether it adequately covered all areas and types of woodland in England and Wales. The other two data sources were complete enumerations of woodland area but this data set only had complete coverage of Forestry Commission sites. It is likely that the database of other woodland in England and Wales was nearly complete for National Trust, country park site and water authority sites (in England only), but for privately owned woodland areas, and other publicly owned sites, the database could be quite lacking.

b. There was a risk that the supply measure suffered from an identification problem. By using woodland recorded as having been visited as a primary source of information for capturing this data, there is a risk that the figures may be biased towards areas visited frequently (and therefore more likely to have turned-up in the sample). It is desirable to have an estimate of total recreational woodland that is independent of recreational demand, but no such data exists. This problem was reduced by the addition of data from other sources to the database but remained a potential problem for the modelling of recreation supply and demand.

Despite these problems this was felt to be the best measure of woodland for recreation in England and Wales because of its detail and appropriateness (ie only woodland suitable for recreation was included).

Measures of the supply of woodland for recreation

After identifying three possible sources of data on the location and area of woodland, the next task of this research was to determine a way in which quantities of woodland could be measured and added together to give a meaningful measure of the supply of woodland for recreation. Given also that the eventual aim was to incorporate these measures in participation or demand equations, it was also desirable to have such a measure linked to the home location of each respondent (ie the parliamentary constituency in which they were interviewed).

The first part of this task was to consider how individual sites could be measured in terms of their recreational supply. Three alternative measures were considered:

a. counting each forest site as one location (ie giving equal weight to both large and small forest areas);

b. estimating the amount of recreation facilities at each site (eg car park spaces, trail lengths and picnic site places); or

c. using forest area as a measure of supply for each site.

Table 4.3.2 shows the distribution of forest areas at sites recorded in the survey. It shows that there is great variation in the area of forest areas at individual sites, so it seemed unlikely that each site could be considered as providing the same quantity of recreation opportunities to the visitor. The first alternative was therefore considered to be an unrealistic and oversimplistic way of measuring the supply of forests for recreation.

The second alternative was thought to be a better measure of supply, but it was also considered to be problematical for several reasons. Firstly, it would be difficult to add up lengths of trail, car parking spaces and numbers of visitor centres and information points etc into a composite measure of supply. For some sites it would also be very difficult to obtain this information, particularly for informal sites, where visitors might park on the road, or where a great deal of recreation takes place on forest roads and tracks, that have not been constructed specifically for recreation purposes. Secondly, there is the problem that the provision of facilities is not necessarily related

Table 4.3.2 Size distribution of forest recreation sites recorded on the forest recreation database

| Size of forest site | England and Wales Forestry Commission | England and Wales Other | Scotland Forestry Commission |
|---|---|---|---|
| Up to 50 ha | 84 | 559 | 22 |
| 51 - 100 ha | 57 | 163 | 21 |
| 101 - 150 ha | 45 | 118 | 9 |
| 151 - 200 ha | 35 | 31 | 12 |
| 201 - 250 ha | 29 | 37 | 8 |
| 251 - 300 ha | 18 | 18 | 9 |
| 301 - 350 ha | 24 | 20 | 11 |
| 351 - 400 ha | 24 | 7 | 9 |
| 401 - 450 ha | 17 | 9 | 10 |
| 451 - 500 ha | 9 | 1 | 8 |
| 501 - 600 ha | 15 | 8 | 13 |
| 601 - 700 ha | 22 | 5 | 11 |
| 701 - 800 ha | 23 | 0 | 18 |
| 801 - 900 ha | 21 | 2 | 14 |
| 901 - 1000 ha | 11 | 2 | 19 |
| Over 1000 ha | 30 | 10 | 63 |
| Total | 464 | 990 | 257 |

Note: Site area could not be estimated for 17 sites in England and Wales to use of a site or even the capacity of a site. Some forest areas are used very intensively but have little provided in the way of facilities, while others have many facilities that have been obtained to meet peak demands, or as a result of skilful bargaining on the part of resource managers with sponsoring bodies, but are not used very much. Finally, it was also felt that there is an intuitive argument that it is not valid to measure inputs to a site (ie facilities) as a proxy for its output (in terms of recreational services). It was decided therefore, not to attempt to quantify the provision of facilities as a measure of forest recreation supply for this study.

The approach chosen was to use the area of woodland as an indicator of the supply of forests for recreation. This had the advantage of being easy to calculate and simple to understand. There were problems with using forest area as a measure of the supply of recreation opportunities, mostly due to possible measurement errors in the data sources (discussed above and in Appendix 2). However, it was felt that this would be the most sensible way to measure forest recreation supply. It also had some of the qualities of the second alternative in that many of the areas recorded on the forest recreation database were areas where facilities were provided, so it also in a way incorporated a measure of the provision of facilities. (The most accurate way of recording the area used for recreation of course, would have been to carry out surveys of where people went and how much forest they used, but this would have been very time consuming with the number of forests recorded in the household surveys, so was not attempted).

Having decided that the area of forest was a suitable measure of recreation supply, the next problem was then to add the areas together in a meaningful way to represent the total supply of forests available to individuals for recreation within any area. Distance between centres of population and each of the forest sites was considered to be crucial to this aggregation process, because more distant forests are more expensive to visit, in terms of time and money, and less likely to be visited (as was shown earlier) and forests and population centres tend to be located in quite separate areas. Bearing in mind that the location of the household interviews was recorded on the basis of parliamentary constituencies, three possible ways of aggregating the areas of woodland about each constituency were considered in the analysis:

a. the proportion of woodland cover within the same county as the parliamentary constituency could be used as a measure of supply;
b. the total area of woodland within a certain distance of each constituency could be used as a measure of supply; or
c. areas of woodland could be added together according to a weighting process giving less weight to areas more distant to each constituency to give a measure of supply.

Calculating the proportion of woodland cover in the county in which each respondent lived was quite easy because the data could be obtained directly from each of the three data sources. However, this measure was felt to be rather arbitrary because no particular reason could be put forward for choosing the area of woodland within a county boundary as opposed to within smaller regions (such as districts or the parliamentary constituencies themselves) or larger regions (such as the 12 standard regions used in UK regional statistics). Many forest visits take place outside the county from which the visit started so this measure may not be very effective as an indicator of the supply of forests, particularly if many visitors cross county boundaries. A further problem with this measure was that counties are different sizes and that the percentage forest cover in any particular county might be correlated with the area of the county itself leading to a biased estimate of woodland supply.

It was also quite easy to calculate the area of woodland within a certain distance of each constituency because with the exception of the Census data, the area and location of all woodland sites was known. However, just as choosing county boundaries seemed rather arbitrary, it was also difficult to justify any one particular distance for this calculation over another. A short distance would result in great variability between each of the constituencies, but exclude the influence of more distant forests on the measure of supply. A longer distance would include more forests and could be justified as capturing the vast majority of travel distances recorded in the sample (for example, a distance of 100 km would capture for each constituency, the forests accounting for 90% of all forest trips). However, this might then overestimate the influence of more distant forests on supply, and would probably result in a low amount of variability between each of the constituencies. It would also not reflect the real availability of forests because it would fail to take into account the effect of distance on participation.

Because of these difficulties it was decided that the most appropriate measure of woodland supply would be one that added together all the areas of woodland around each constituency, but gave gradually less weight to woodlands further away. This weighting could be derived from the distance function reported earlier, and would be used to arrive at a distance-weighted area of woodland for each constituency. Further details of how this function was determined are given below. However the other two measures were also calculated for each constituency (using a cut-off point of 50 km for the second measure) to compare with each other and to see if they had a higher degree of explanatory power in the recreation demand models that were constructed.

Calculation of distance-weighted forest areas

The calculation of an appropriate weighting function started with consideration of the correct functional form for such an equation. Assuming every possible starting point in the country is surrounded by homogeneous forest cover in all directions, and that the forest is all of equal quality for recreation, then the area of forest available to visit within a given distance can be expressed as:

$$A = pi.d^2.f$$

where $A$ = the area of forest available to visit

$d$ = distance

$f$ = the percentage of land covered with forest

Now, assuming that the area of forest is an appropriate measure of supply for recreation, the total area of forest available to visit from any starting point would be:

$$A_m = pi.{d_m}^2.f$$

where $d_m$ is the maximum distance individuals would consider travelling on a day visit to a forest. Assuming that all forests are equally likely to be chosen (ie the decision to visit any particular forest is made randomly), the probability of visiting a forest within a given distance can then be calculated as:

$$p(d) = (d/d_m)^2 \text{ or } (1/d_m)^2 . d^2$$

However, this is based on assumptions that make each forest equally likely to be chosen as a destination for a day trip, such as:

a. that all forests are equally attractive in terms of their features and accessibility;
b. that trips are not biased in any particular direction;
c. that congestion does not occur at sites, making some sites less attractive than others;
d. that travel and other costs do not make more distant forests less likely to be visited. and
e. that forest cover is homogeneous in all directions.

In reality individuals face both time and income constraints in their household budgets, so there are costs associated with visiting forests at different distances. Assuming that there are no fixed costs in making a visit, and that individuals face constant marginal costs of making a visit, with respect to distance travelled, then more distant forests will be more expensive to visit. A demand curve of the form shown below would typically represent the quantity of visits individuals would want to make at different costs (or distances):

$$Qd = a.T.(2.c.d)^b$$

Where Qd = Number of visits an individual would make to a forest at distance d.

T = Total number of trips out an individual would like to take (based on leisure time availability and socio-economic factors).

a = A variable measuring the proportion of total trips that would be forest trips (based on another set of socio-economic factors and variables such as tastes or preferences for forest visits).

c = The marginal cost of travelling per unit of d.

d = One-way trip distance.

b = Price elasticity of demand for forest visits.

The influence of such a demand curve can be incorporated into the above probability function, such that the probability function becomes:

$$p(Qd) = \frac{\text{Aggregate demand for forests within distance d}}{\text{Aggregate demand for forests within the maximum distance}}$$

This can be calculated by differentiating the probability of making trips within a given distance - p(d), with respect to distance (to arrive at the number of forests at each distance), multiplying it by the demand function Qd (to get the total demand for forests at each distance) and re-integrating the result (to arrive at the aggregate demand for forest visits within each given distance) to give the top and bottom of this fraction. Most of the resultant terms cancel on both sides of the fraction to leave the function:

$$p(Qd) = (1/d_m)^{b+2} . d^{b+2}$$

This probability function has the following interesting properties:

a. When $b = 0$, the function is the same as the original: $p(d) = (d/d_m)^2$, and most visits would occur at some distance to where individuals started because the number of available forests increases with distance.

b. When $b = -1$, the function becomes linear indicating that the increased number of forests that travelling further offers is exactly counteracted by the increased cost of visiting them such that individuals over a long period of time would on average make an equal number of visits to forests at each possible distance.

c. As b approaches -2 the function tends towards a situation where all visits would take place at the starting location. If this were the case, there would be no incentive to look further afield for trips because the elasticity of demand dictates that the greater number of forests available to individuals travelling further is offset by the effect this would have on underlying demand for forest visits through the price mechanism.

This formulation would also imply that the maximum elasticity of demand that could be observed will be -2 but this is essentially the result of carrying out algebraic manipulations with concentric circles to define distance zones.

Of course, in reality, several of the assumptions underlying this exposition are violated: sites are not of equal quality and evenly spread out, congestion of sites occurs, and there is directional and distance preferences on both the part of individuals and in the provision of infrastructure. However, this formulation is theoretically appealing and would suggest that the relationship between the probability of visiting a site and distance should be estimated as a function of the form:

$$p(d) = ad^{b}$$

$$\text{or} \quad \mathrm{Ln}\, p(d) = a + b\mathrm{Ln}d$$

Figure 4.3.1 shows the distribution of the probabilities of visiting sites within different distances recorded in the surveys in England/Wales and Scotland. A log-linear (or double-log) relationship was estimated for the data and is also shown in Figure 4.3.1. The regression equation defining this relationship was as follows:

$$\underset{}{\mathrm{Ln}\, p(d)} = \underset{(0.05)}{-1.58} + \underset{(0.02)}{0.36}\ \mathrm{Lnd}$$

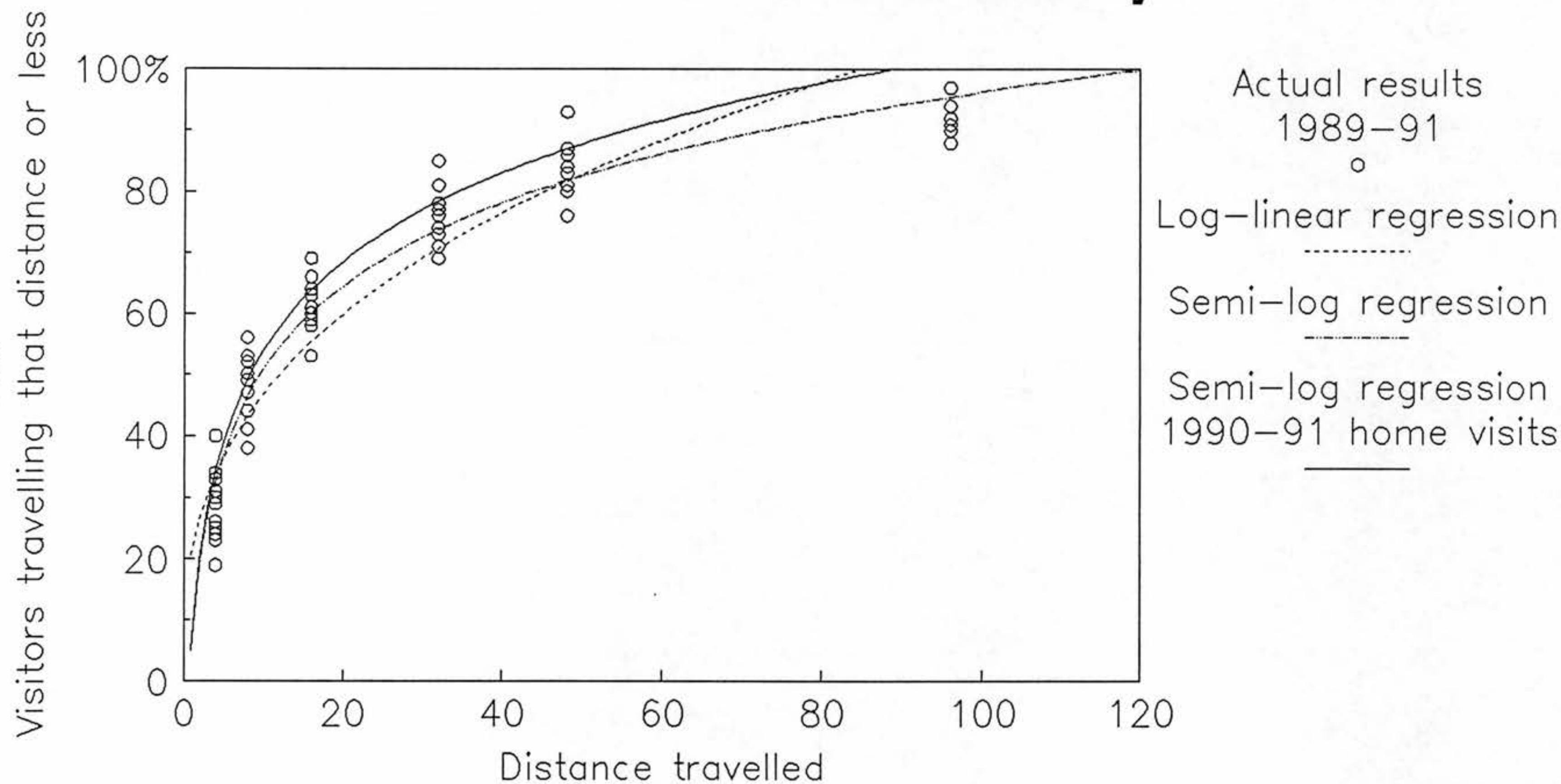
R-squared = 0.86

n = 72 (ie 12 sets of monthly results with 6 distance bands in each)

Standard errors shown in parentheses

It can be seen that the relationship underestimates the probability of short distance visits when this functional form is used. This could be either as a result of the identification problem referred to earlier or

Figure 4 . 3 . 1 Analysis of distance travelled data from the 1989-1991 household surveys



due to some of the assumptions underlying the functional form being incorrect.

Examining the identification problem first, there are two major factors that can explain why the results might be different to what was theoretically postulated. Firstly, as any map of Britain will show, forests are not evenly spread across the land and people do not generally live close to forests. This spatial imbalance would tend to result in a lower number of visits at short distances than theory would predict, but this would work in the opposite way to what was observed (although the rather wide definition of a forest used by respondents may lessen the impact of this imbalance). More seriously however, the question of distance on the last forest outing was only asked of those that had been to a forest on the last outing or had made a forest outing in the previous 4 weeks. A basic premise that this work set out to examine is that close proximity to forests leads to more forest visits, which would suggest that those that had answered this question (more frequent visitors) might live in areas where forests are close by. This would bias results towards a greater number of short distance visits than if a more random sample of the public had been asked about how far they had been on their last trip to a forest.

In an attempt to examine this further, another data set on visits to a wide range of forest sites was examined (Hanley and Ruffel, 1992) to see if the distances recorded in site interviews followed a similar pattern. The results for both holidaymakers (when only distance from a holiday base was considered) and for visitors starting from home, were similar to the results obtained in the household interviews (Hanley and Ruffel - p 43). Because these interviews were conducted with both regular and less frequent visitors at a range of sites both close and distant to centres of population the results seemed to indicate that reasons other than identification bias may lead to a greater number of short distance visitors than theory would predict.

Apart from the identification problem, the most plausible explanation that could be put forward to explain why more short visits might occur than theory would predict would be if marginal costs rose with distance travelled. It could not be seen how this could be the case with the material costs of travelling, but it was thought possible that this might be the case with the cost of travelling time, particularly if leisure time is constrained for respondents. An alternative explanation was also that the marginal utility of leisure travelling itself may change as travelling time increases, explaining this result. This would be an area for useful further research.

Because the log-linear specification did not give a very good fit to the data, further estimations were performed (semi-log formulations, and functions using d/d max as an independent variable) and a semi-log formulation turned out to be the best at explaining the relationship between the probability of visiting forests and distance. The functional form used was:

$$p(d) = a + b\text{Ln}d$$

and the regression coefficients estimated were as follows:

$$p(d) = \underset{(0.02)}{0.05} + \underset{(0.01)}{0.20}\text{Ln}d$$

$$R\text{-squared} = 0.95$$

$$n = 72$$

This function appeared to fit the data more closely (the R-squared statistics between this and the previous equation are not directly comparable because of the different functional forms used). However, two attributes of the data set still suggested, that this may not be an accurate relationship to use for accounting for the distance to forests on the overall supply of forests. Firstly, the data set included the distance to forests recorded in the surveys from May to October 1989. The sampling procedure used in these months only recorded information about visits of over 3 hours duration, which biased the results towards visits to more distant sites (see Figure 4.2.2). Secondly, visits from both home and holiday locations were included in the data set. Analysis of the data showed that there was a significant difference between distances travelled from home and from a holiday location and, although the aim was to find a composite supply measure for forests around any starting location, the starting location for visits taken while on holiday was not known. So, in any demand analysis, the dependent variable (the probability of making a forest visit) could only be related to a measure of the supply of forests around the respondent's home. Because of this, a further estimation was performed using only the data collected in 1990 and 1991, and excluding data on the distance travelled to forests while on holiday. The results of this estimation were very similar to those above and are presented below:

$$P(d) = 0.05 + 0.21 \, Lnd$$
$$(0.03) + (0.01)$$

R-squared = 0.94

n = 42

This equation was used to account for the effect of distance on the supply of forests to visit for respondents in each constituency, by giving a higher weight to closer forests and less weight to gradually more distant forests, so that the area and location of forests around each constituency could be combined into a composite measure of the potential supply of forests. In effect the weights were distributed according to this probability function so that they took into account the area of each woodland and the effect of distance on the probability of visiting each woodland.

To do this, the above equation was differentiated to get the marginal probability of visiting a forest at each distance. The area of each forest around a location was then multiplied by these marginal probabilities (which depended on the distance between each forest and the starting location) and the resultant areas were added together to arrive at a measure that combined both size and distance into a single measure of supply for forests around that location. To show how this takes into account both distance and amount of forest surrounding a location, an illustration is useful.

A typical location in Britain could be expected to be surrounded by about 10% forest cover on average. Of this, about 10% might be open or accessible to the public. If this forest cover was evenly distributed, the total supply measure of forests would be calculated using the above function as:

$$S_l = \sum_{d=1}^{120} 0.21/d \times A_d$$

where $S_l$ = total potential supply of forests for location 1

$A_d$ = area of forest at each distance

d = distance between forest and location 1 (assumed maximum of 120 km)

and total distance-weighted supply for this location would be 3 684 ha.

If however, there was a large wood of say, 3 000 ha ranging from 18-20 km from the location, then using the above equation, the supply of forests at that location would be increased to 3 717 ha, and if the wood was only 8-10 km from the location, the supply measure would increase to 3 754 ha. In reality, none of the constituencies recorded figures as high as this because forest cover is not evenly distributed and hardly anywhere in Britain is it possible to draw a circle with a radius of 120 km without including large areas of sea. The highest figure calculated from the forest recreation database was for the New Forest parliamentary constituency which measured 981 distance-weighted hectares (dwha). The New Forest also had one of the highest figures for total forest area (as measured by the satellite data) of 2 073 dwha.

Using the above formula, the distance-weighted area of woodland was calculated for all parliamentary constituencies along with the area of woodland less than 50 km away, and the percentage woodland cover of the county or region. Comparisons between counties and constituencies and between each of these three measures are given in the next section below.

Comparison of woodland supply across counties/regions and between the alternative supply measures and data sources

The three different sources of data on woodland supply and three different ways of aggregating areas into a measure of total supply were used to calculate forest supply measures for every county/region and parliamentary constituency. This led to some interesting differences in supply between counties/regions and highlighted deficiencies in the data sources and provided further evidence as to the most appropriate way to calculate total supply measures.

Taking the simplest measure first, Table 4.3.3 shows the percentage forest cover by county/ region estimated from each of the three data sources. Comparing the census and satellite data (see Figure 4.3.2), it can be seen that the satellite data recorded much lower proportions of woodland cover than the census data in Scotland and much higher proportions in Wales (with the exception of Gwent). Most of the results for England were within 2-3 percentage points of each other except the results for Kent, Northumberland, Cornwall and Greater Manchester.

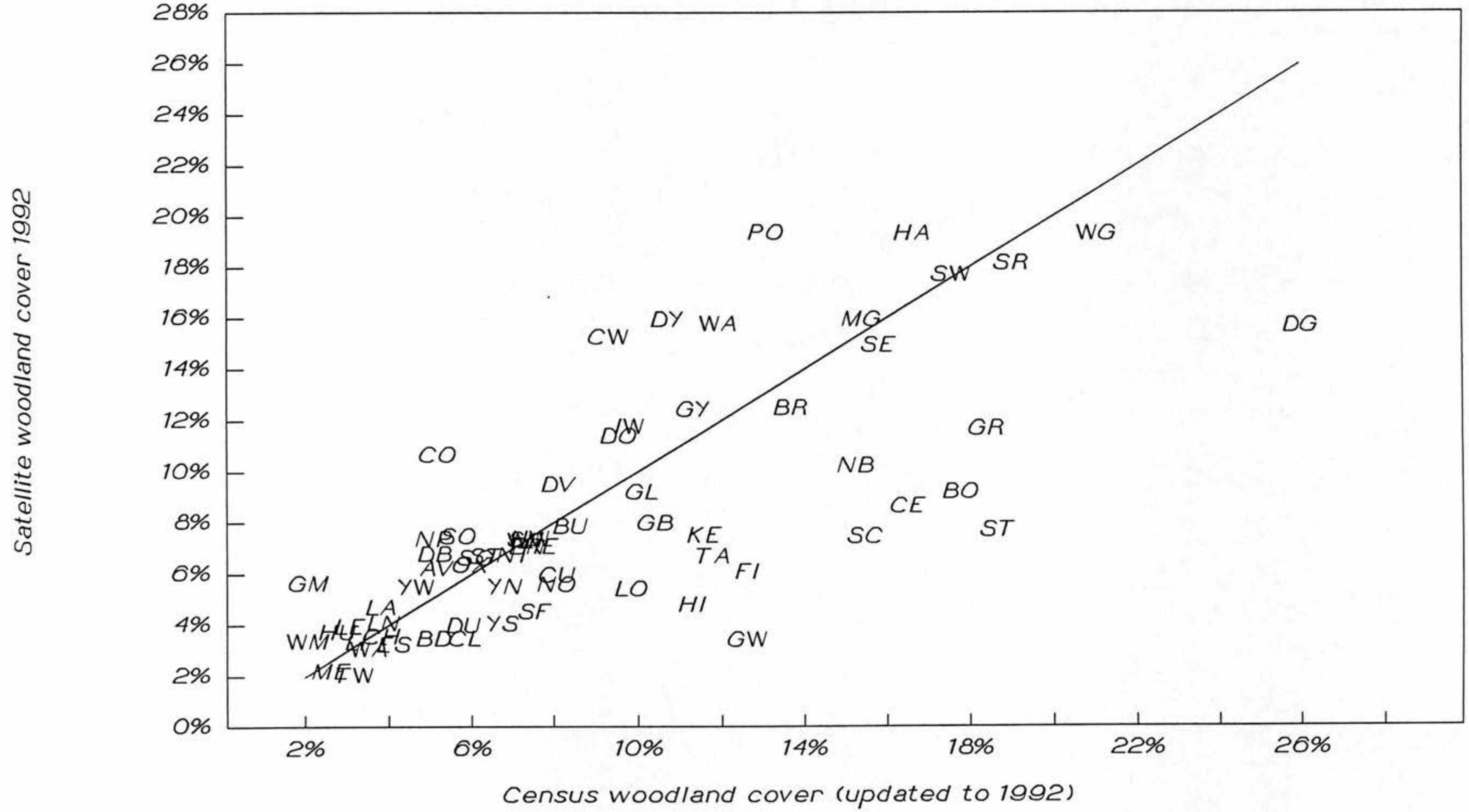
It was thought that the underestimation of woodland cover in the satellite data was probably due to the inability of the of the computer programs interpreting the data to differentiate between young plantations and heather moorland. This would explain the differences in Scotland (although not the differences in Wales). Both of these data sources gave estimates of total woodland cover so the results should have been very similar and the large differences between the two sources gave some cause for concern. Because the census data was

Table 4.3.3 Comparison of forest cover by county between 1980 census data (updated to 1992), 1992 satellite data, and forest recreation database data collected in the household surveys

| County | | Woodland cover as a proportion of county area | | | | | | Average area of woodland within 50 kmof each constituency in county | | | | Average distance-weighted woodland area calculated for each constituency | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Census data | rank | Satellite data | rank | Forest recreation Database data | rank | Satellite data | rank | Forest recreation Database data | rank | Satellite data | rank | Forest recreation Database data | rank |
| Avon | AV | 5.2% | 29 | 6.1% | 24 | 0.9% | 36 | 65,239 | 12 | 16,416 | 9 | 1,439 | 5 | 334 | 8 |
| Bedfordshire | BD | 5.1% | 32 | 3.4% | 38 | 1.9% | 17 | 44,861 | 25 | 11,756 | 20 | 959 | 21 | 263 | 16 |
| Berkshire | BR | 13.7% | 6 | 12.4% | 5 | 1.9% | 15 | 100,350 | 3 | 17,730 | 6 | 1,600 | 3 | 382 | 2 |
| Buckinghamshire | BU | 8.4% | 11 | 7.8% | 12 | 1.6% | 22 | 72,752 | 9 | 16,636 | 8 | 1,386 | 9 | 351 | 5 |
| Cambridgeshire | CA | 2.0% | 46 | 1.5% | 46 | 0.2% | 46 | 29,063 | 42 | 6,636 | 39 | 635 | 39 | 187 | 38 |
| Cheshire | CH | 3.8% | 36 | 3.5% | 37 | 1.1% | 30 | 44,266 | 26 | 8,167 | 33 | 990 | 20 | 199 | 35 |
| Cleveland | CL | 5.8% | 25 | 3.4% | 39 | 2.0% | 11 | 33,303 | 37 | 12,535 | 19 | 585 | 42 | 203 | 33 |
| Cornwall | CO | 5.2% | 28 | 10.6% | 8 | 0.6% | 43 | 35,171 | 34 | 2,219 | 46 | 564 | 43 | 45 | 46 |
| Cumbria | CU | 8.1% | 13 | 5.9% | 25 | 1.9% | 13 | 45,086 | 23 | 16,722 | 7 | 938 | 22 | 307 | 13 |
| Derbyshire | DB | 5.1% | 30 | 6.7% | 20 | 1.8% | 18 | 49,866 | 19 | 16,062 | 10 | 884 | 26 | 253 | 19 |
| Devon | DV | 8.1% | 12 | 9.4% | 10 | 1.1% | 31 | 55,944 | 16 | 6,712 | 38 | 861 | 27 | 129 | 44 |
| Dorset | DO | 9.5% | 10 | 11.3% | 7 | 1.7% | 20 | 79,225 | 5 | 25,495 | 3 | 1,303 | 12 | 346 | 6 |
| Durham | DU | 5.8% | 26 | 3.9% | 34 | 1.0% | 32 | 28,258 | 43 | 6,385 | 40 | 719 | 36 | 224 | 26 |
| East Sussex | SE | 15.8% | 4 | 14.9% | 4 | 2.0% | 12 | 67,336 | 10 | 9,257 | 27 | 1,031 | 19 | 201 | 34 |
| Essex | ES | 4.1% | 34 | 3.2% | 42 | 0.7% | 41 | 32,777 | 38 | 9,570 | 26 | 787 | 33 | 219 | 27 |
| Gloucestershire | GL | 10.1% | 8 | 9.1% | 11 | 3.4% | 5 | 59,114 | 15 | 14,860 | 15 | 1,448 | 4 | 337 | 7 |
| Greater London | LN | 3.9% | 35 | 4.0% | 32 | 3.5% | 4 | 74,634 | 7 | 18,440 | 5 | 1,172 | 15 | 324 | 10 |
| Greater Manchester | GM | 2.1% | 44 | 5.5% | 26 | 0.9% | 38 | 44,047 | 27 | 8,578 | 29 | 900 | 24 | 210 | 30 |
| Hampshire | HA | 16.6% | 3 | 19.3% | 1 | 8.9% | 1 | 115,016 | 1 | 34,351 | 1 | 1,674 | 1 | 495 | 1 |
| Hereford & Worcester | HW | 7.4% | 17 | 7.3% | 15 | 0.9% | 39 | 60,276 | 13 | 12,718 | 18 | 1,356 | 10 | 260 | 17 |
| Hertfordshire | HE | 7.7% | 15 | 7.0% | 19 | 1.8% | 19 | 48,103 | 21 | 14,850 | 16 | 1,115 | 16 | 293 | 14 |
| Humberside | HU | 2.8% | 42 | 3.6% | 36 | 0.4% | 45 | 25,325 | 45 | 3,921 | 45 | 531 | 44 | 133 | 43 |
| Isle of Wight | IW | 9.8% | 9 | 11.7% | 6 | 3.6% | 3 | 77,690 | 6 | 33,094 | 2 | 1,182 | 14 | 327 | 9 |
| Kent | KE | 11.6% | 7 | 7.4% | 13 | 2.2% | 10 | 49,635 | 20 | 10,371 | 24 | 835 | 29 | 198 | 36 |
| Lancashire | LA | 3.8% | 37 | 4.6% | 30 | 0.5% | 44 | 31,804 | 39 | 4,817 | 44 | 719 | 37 | 161 | 41 |
| Leicestershire | LE | 3.1% | 41 | 3.9% | 35 | 0.7% | 42 | 37,185 | 32 | 8,530 | 30 | 765 | 34 | 204 | 31 |
| Lincolnshire | LI | 3.2% | 39 | 3.2% | 41 | 0.8% | 40 | 29,410 | 41 | 7,377 | 36 | 600 | 41 | 163 | 40 |
| Merseyside | ME | 2.6% | 43 | 2.1% | 44 | 1.4% | 26 | 34,750 | 35 | 6,252 | 42 | 854 | 28 | 180 | 39 |
| Norfolk | NO | 8.0% | 14 | 5.5% | 27 | 1.2% | 28 | 30,597 | 40 | 6,377 | 41 | 446 | 46 | 110 | 45 |
| North Yorkshire | YN | 6.8% | 21 | 5.4% | 28 | 1.9% | 16 | 39,447 | 31 | 10,767 | 21 | 678 | 38 | 192 | 37 |
| Northamptonshire | NP | 5.1% | 31 | 7.3% | 16 | 1.4% | 25 | 36,914 | 33 | 7,476 | 35 | 900 | 25 | 218 | 29 |
| Northumberland | NB | 15.2% | 5 | 10.1% | 9 | 5.9% | 2 | 41,712 | 29 | 15,428 | 12 | 732 | 35 | 228 | 24 |
| Nottinghamshire | NT | 7.0% | 20 | 6.6% | 21 | 2.9% | 6 | 47,175 | 22 | 15,019 | 14 | 797 | 32 | 246 | 20 |
| Oxfordshire | OX | 6.0% | 24 | 6.3% | 23 | 1.0% | 34 | 59,803 | 14 | 10,488 | 23 | 1,325 | 11 | 315 | 11 |
| Shropshire | SH | 7.3% | 18 | 7.2% | 17 | 1.0% | 35 | 66,067 | 11 | 7,271 | 37 | 1,407 | 8 | 234 | 22 |
| Somerset | SO | 5.7% | 27 | 7.4% | 14 | 1.6% | 21 | 52,639 | 17 | 9,013 | 28 | 1,233 | 13 | 292 | 15 |
| South Yorkshire | YS | 6.7% | 22 | 4.0% | 33 | 2.3% | 9 | 52,165 | 18 | 15,480 | 11 | 817 | 30 | 259 | 18 |
| Staffordshire | ST | 6.3% | 23 | 6.6% | 22 | 1.6% | 23 | 44,883 | 24 | 10,550 | 22 | 1,080 | 17 | 224 | 25 |
| Suffolk | SF | 7.5% | 16 | 4.4% | 31 | 1.9% | 14 | 26,430 | 44 | 8,170 | 32 | 462 | 45 | 147 | 42 |
| Surrey | SR | 19.0% | 1 | 18.1% | 2 | 2.5% | 7 | 114,115 | 2 | 20,752 | 4 | 1,623 | 2 | 353 | 4 |
| Tyne & Wear | TW | 3.2% | 40 | 2.0% | 45 | 0.9% | 37 | 25,257 | 46 | 6,207 | 43 | 622 | 40 | 204 | 32 |
| Warwickshire | WA | 3.5% | 38 | 3.0% | 43 | 1.0% | 33 | 34,471 | 36 | 7,667 | 34 | 901 | 23 | 231 | 23 |
| West Midlands | WM | 2.1% | 45 | 3.3% | 40 | 1.4% | 24 | 40,483 | 30 | 10,112 | 25 | 1,067 | 18 | 240 | 21 |
| West Sussex | SW | 17.5% | 2 | 17.6% | 3 | 2.5% | 8 | 95,852 | 4 | 14,730 | 17 | 1,435 | 6 | 309 | 12 |
| West Yorkshire | YW | 4.6% | 33 | 5.4% | 29 | 1.2% | 29 | 42,564 | 28 | 8,246 | 31 | 810 | 31 | 219 | 28 |
| Wiltshire | WI | 7.2% | 19 | 7.2% | 18 | 1.2% | 27 | 72,782 | 8 | 15,030 | 13 | 1,417 | 7 | 367 | 3 |
| Total | EN | 7.3% | | 7.0% | | 1.8% | | 67,162 | | 16,069 | | 998 | | 252 | |
| Clwyd | CW | 9.3% | 7 | 15.2% | 5 | 1.7% | 6 | 71,317 | 6 | 9,022 | 8 | 1,254 | 7 | 194 | 7 |
| Dyfed | DY | 10.7% | 6 | 15.8% | 4 | 2.5% | 5 | 92,917 | 5 | 12,423 | 6 | 1,498 | 5 | 206 | 6 |
| Gwent | GW | 12.6% | 4 | 3.3% | 8 | 3.1% | 3 | 97,638 | 2 | 27,974 | 1 | 1,743 | 3 | 359 | 2 |
| Gwynedd | GY | 11.3% | 5 | 12.3% | 6 | 2.7% | 4 | 61,503 | 8 | 10,345 | 7 | 976 | 8 | 140 | 8 |
| Mid Glamorgan | MG | 15.4% | 2 | 15.9% | 3 | 7.1% | 1 | 97,152 | 3 | 22,298 | 2 | 1,791 | 2 | 413 | 1 |
| Powys | PO | 13.1% | 3 | 19.3% | 1 | 1.7% | 7 | 145,415 | 1 | 17,732 | 5 | 2,075 | 1 | 267 | 5 |
| South Glamorgan | SG | 6.1% | 8 | 6.5% | 7 | 1.6% | 8 | 67,282 | 7 | 20,721 | 3 | 1,385 | 6 | 281 | 4 |
| West Glamorgan | WG | 21.0% | 1 | 19.2% | 2 | 3.7% | 2 | 94,698 | 4 | 19,562 | 4 | 1,680 | 4 | 318 | 3 |
| Total | WA | 11.9% | | 15.7% | | 2.5% | | 87,918 | | 18,342 | | 1,543 | | 287 | |
| Borders | BO | 17.8% | 4 | 9.1% | 3 | 1.1% | 8 | 87,388 | 2 | 23,137 | 4 | 1,269 | 2 | 365 | 4 |
| Central | CE | 16.5% | 5 | 8.6% | 4 | 8.4% | 1 | 60,589 | 4 | 25,365 | 3 | 1,229 | 4 | 434 | 3 |
| Dumfries & Galloway | DG | 25.9% | 1 | 15.6% | 1 | 5.3% | 2 | 102,107 | 1 | 25,695 | 1 | 1,675 | 1 | 603 | 1 |
| Fife | FI | 12.6% | 6 | 6.0% | 7 | 1.8% | 5 | 42,101 | 8 | 6,934 | 8 | 986 | 7 | 272 | 6 |
| Grampian | GR | 18.4% | 3 | 11.6% | 2 | 1.4% | 7 | 63,048 | 3 | 7,134 | 7 | 988 | 6 | 143 | 8 |
| Highland & Islands | HI | 11.3% | 8 | 4.7% | 9 | 1.5% | 6 | 26,953 | 9 | 6,313 | 9 | 525 | 9 | 139 | 9 |
| Lothian | LO | 9.8% | 9 | 5.4% | 8 | 0.5% | 9 | 43,759 | 7 | 7,929 | 6 | 1,056 | 5 | 295 | 5 |
| Strathclyde | ST | 18.6% | 2 | 7.6% | 5 | 3.5% | 3 | 59,555 | 5 | 25,495 | 2 | 1,237 | 3 | 435 | 2 |
| Tayside | TA | 11.8% | 7 | 6.6% | 6 | 1.9% | 4 | 46,775 | 6 | 9,054 | 5 | 983 | 8 | 243 | 7 |
| Total | SC | 15.4% | | 7.4% | | 2.5% | | 54,969 | | 17,115 | | 1,110 | | 342 | |
| Total | GB | 10.4% | | 7.9% | | 1.6% | | 55,950 | | 13,387 | | 1,043 | | 264 | |

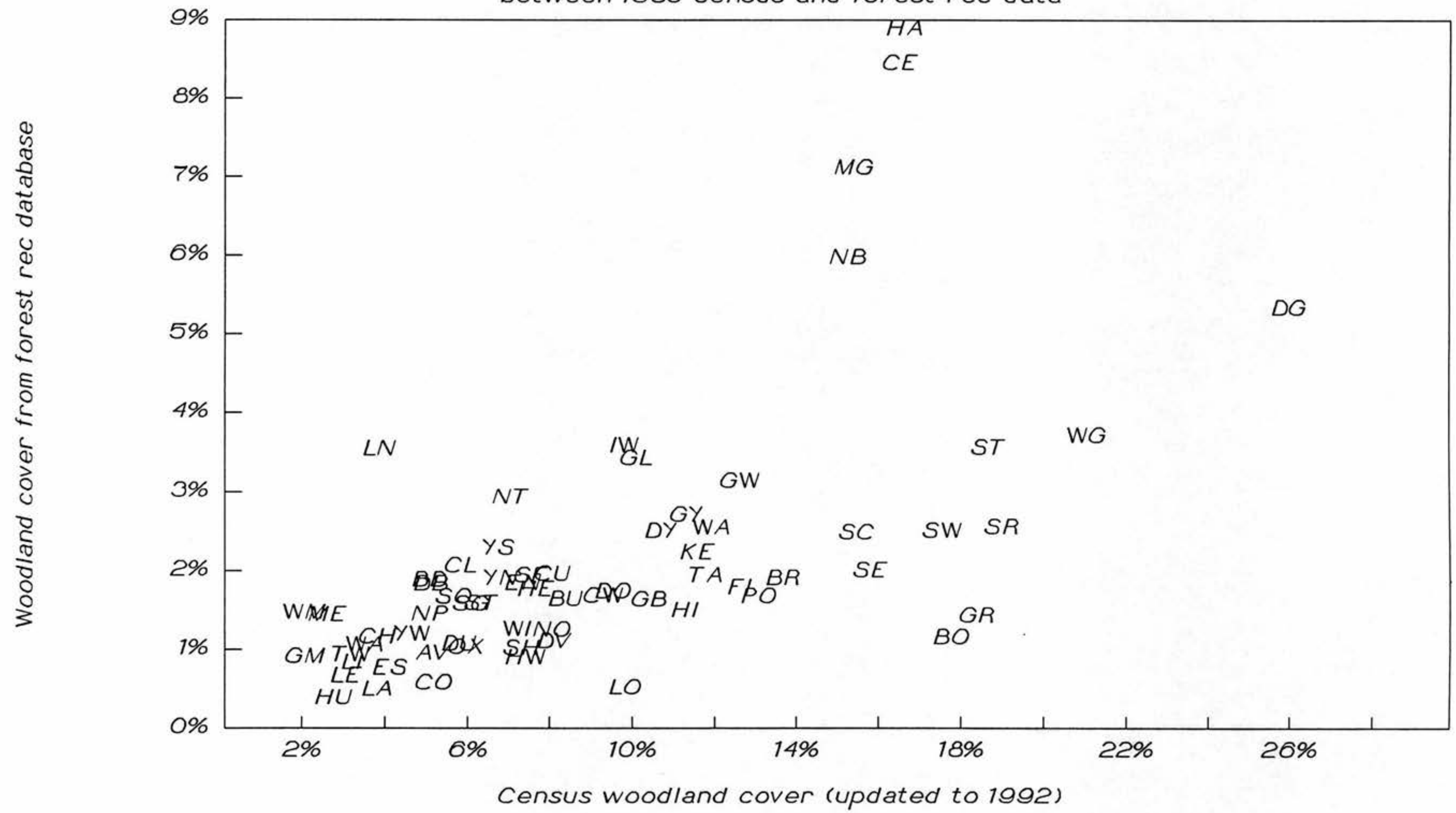
# Figure 4.3.2 Comparison of forest cover

between 1980 census and satellite data



# Figure 4.3.3 Comparison of forest cover

between 1980 census and forest rec data



collected from a major field survey of woodlands in Britain, it was decided that this was probably a more reliable source of data on woodland cover than the satellite data. It was limiting however, in that the census data was not available at a more detailed level of spatial resolution. As the satellite data was available at a more detailed level, it had to be used in the calculation of the other two measures of supply, and the deficiencies in the data, particularly in Scotland and Wales, had to be noted in the results.

Comparing the census data to the forest recreation database data (see Figure 4.3.3), it was found that about 27% of forest areas (by county) in England and 24% in Wales were used or made available in some way for recreation. A much lower figure of 17% was recorded in Scotland, but this partly reflected the fact that only Forestry Commission recreation areas within forests had been included in the recreation database there. The highest figures for recreational woodland compared to total woodland were found in the English metropolitan counties and Hampshire, all of which showed that about 50% or more of the census woodland area was also included in the forest recreation database.

Because part of the aim of this analysis was to compare woodland cover between different counties/regions, it was also decided to examine the rank correlation between the percentages of woodland cover calculated from each of the three sources. Spearman's rank correlation coefficients (Koutsoyiannis, 1977) were calculated for each of the data sources in each of the three countries and are shown in Table 4.3.4. The results showed that all three sources gave significantly similar rankings for counties in England and that the census and satellite figures for Scottish regions, while being very different in absolute

Table 4.3.4 Spearman's rank correlation coefficients for rankings of forest cover between counties calculated as a proportion of county area, average area within 50 km of parliamentary constituencies within counties and average distance-weighted area for each constituency within counties, from census, satellite and forest recreation database data.

| Data source and measure of forest area | Data source and measure of forest area | | | | | |
|---|---|---|---|---|---|---|
| | Woodland as a % of county area | | | Woodland within 50km | | D-W area |
| | Census data | Satellite data | Database data | Satellite data | Database data | Satellite data |
| England | | | | | | |
| Percent cover from satellite | <u>0.836</u> | | | | | |
| Percent cover from database | <u>0.674</u> | <u>0.489</u> | | | | |
| Area within 50km from satellite | <u>0.655</u> | <u>0.758</u> | <u>0.533</u> | | | |
| Area within 50km from database | <u>0.575</u> | <u>0.504</u> | <u>0.714</u> | <u>0.765</u> | | |
| Weighted area from satellite | <u>0.460</u> | <u>0.580</u> | <u>0.357</u> | <u>0.883</u> | <u>0.649</u> | |
| Weighted area from database | <u>0.446</u> | <u>0.464</u> | <u>0.488</u> | <u>0.786</u> | <u>0.842</u> | <u>0.854</u> |
| Wales | | | | | | |
| Percent cover from satellite | 0.619 | | | | | |
| Percent cover from database | 0.738 | 0.143 | | | | |
| Area within 50km from satellite | 0.643 | 0.452 | 0.262 | | | |
| Area within 50km from database | 0.381 | -0.190 | 0.381 | 0.524 | | |
| Weighted area from satellite | 0.667 | 0.524 | 0.262 | <u>0.952</u> | 0.619 | |
| Weighted area from database | 0.548 | 0.071 | 0.524 | 0.619 | <u>0.929</u> | 0.714 |
| Scotland | | | | | | |
| Percent cover from satellite | <u>0.867</u> | | | | | |
| Percent cover from database | 0.467 | 0.317 | | | | |
| Area within 50km from satellite | <u>0.800</u> | <u>0.967</u> | 0.233 | | | |
| Area within 50km from database | 0.683 | 0.650 | 0.583 | <u>0.733</u> | | |
| Weighted area from satellite | <u>0.717</u> | <u>0.717</u> | 0.233 | <u>0.817</u> | <u>0.850</u> | |
| Weighted area from database | 0.616 | 0.517 | 0.517 | 0.600 | <u>0.917</u> | <u>0.900</u> |

Note: significant correlations shown underlined terms, also gave similar rankings of forest cover. None of the data sources gave significantly similar rankings in Wales largely due to the widely different rankings given to Gwent and Powys in each of the data sources.

Examining the results as a whole, the counties of Surrey, West Sussex, Hampshire, East Sussex, Northumberland, Berkshire and Kent had the highest proportion of total woodland cover in England, and Cambridgeshire, West Midlands, Greater Manchester, Merseyside and Humberside the lowest. In terms of recreational woodland, the ordering of counties was slightly different, with Hampshire, Northumberland, Isle of Wight, Greater London, Gloucestershire, Nottinghamshire and Surrey coming top of the list and Cambridgeshire, Humberside, Lancashire, Cornwall and Leicestershire coming bottom. The ordering of recreational woodlands was to a large extent influenced by the presence of large areas of Forestry Commission woodland used for recreation in certain counties (eg New Forest in Hampshire, Kielder Forest in Northumberland, Forest of Dean in Gloucestershire, Sherwood Forest in Nottinghamshire and Alice Holt Forest in Surrey).

The rankings in Wales and Scotland also showed similarities between the census figures and recreation database figures with the exception of Powys (ranked third out of the Welsh counties in terms of woodland cover but only seventh in terms of recreational woodland), Central Region (ranked fifth in terms of total woodland cover but first in terms of recreational woodlands), and Grampian (ranked third in the census statistics and seventh in terms of recreational woodland).

The middle two columns of Table 4.3.3 show the average area of woodland within 50 km of each parliamentary constituency within counties/regions, calculated from the satellite data and forest recreation database data. Forest supply calculated in this way showed similar rankings of counties/regions to the woodland cover figures, the most notable changes being in areas that were close to large forests just outside their boundaries (eg the Forest of Dean raised the ranking of Avon from 24th to 12th using the satellite data or 36th to 9th using the forest recreation database data, and had a similar effect on Gwent and Hereford and Worcester, the ranking of Greater London in terms of the total area of woodland measured by the satellite data also rose from 32nd to 7th when all the surrounding woods in the Home Counties were taken into consideration). Correlation of this measure with the other measures was significant in England for rankings calculated from both data sources, and significant in most cases in Scotland for rankings calculated from the satellite data.

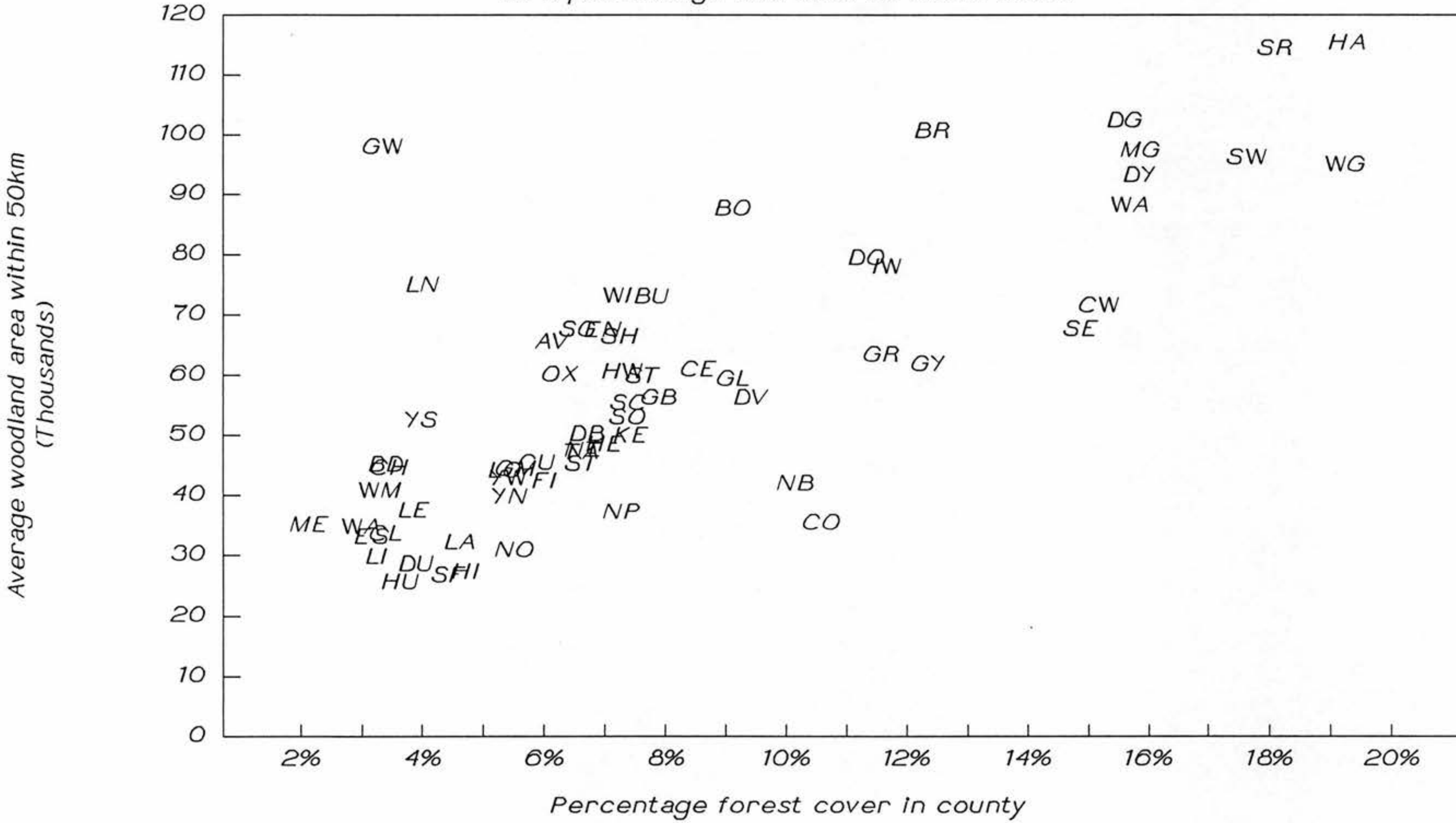
The final two columns of Table 4.3.3 show the average distance-weighted areas of woodland calculated for all constituencies within each county/region and using the satellite and forest recreation database data. The ranking of woodland supply measured in this way varied little from the measure calculated by aggregating the area of woodland less than 50 km away. This similarity was also reflected in the correlation coefficients which were highest of all for distance-weighted and total area within 50 km measures calculated from the same data source. Again, in England, the counties with the highest level of supply were predominantly in Southern England (eg Hampshire, Surrey, Berkshire, Gloucestershire, Avon, West Sussex and Wiltshire came top of the list on the basis of the satellite data), while the lowest were to be found in East England (Norfolk, Suffolk, Humberside and Lincolnshire).

The correlation between results aggregated in the three alternative ways, but from a single data source (in this case the satellite data) is shown in Figures 4.3.4 to 4.3.6. These show that there is a very weak linear correlation between the percentage forest cover and the average area of wood within 50 km of constituencies in a county. The correlation is even weaker between forest cover and distance weighted area. As has already been discussed, there is no evidence to suggest that the percentage forest cover figure for a county will be a good indicator of supply because it ignores woodland outside the county and depends on many arbitrary factors such as the shape of the county and its relative size (smaller counties tend to be more urbanised and therefore have a lower proportion of forest cover). One of the latter two alternative methods of calculating forest supply should therefore, be a better explanatory variable to build into the models of recreation demand in the next section.

Figure 4.3.6 shows the correlation between the latter two alternative methods of calculating supply, which can be seen to be very strong but also slightly non-linear. Thus, for example, the most wooded county (Powys) is five times more wooded than the least wooded (Suffolk) using the woodland within 50 km measure, but less than five times more wooded using the distance-weighted area measure. This might therefore, lead to differences in empirical results that would suggest that one of these alternatives is a better measure of supply (in terms of its ability to explain visitor numbers) than the other. This is examined further in the next section on modelling demand for recreation visits.

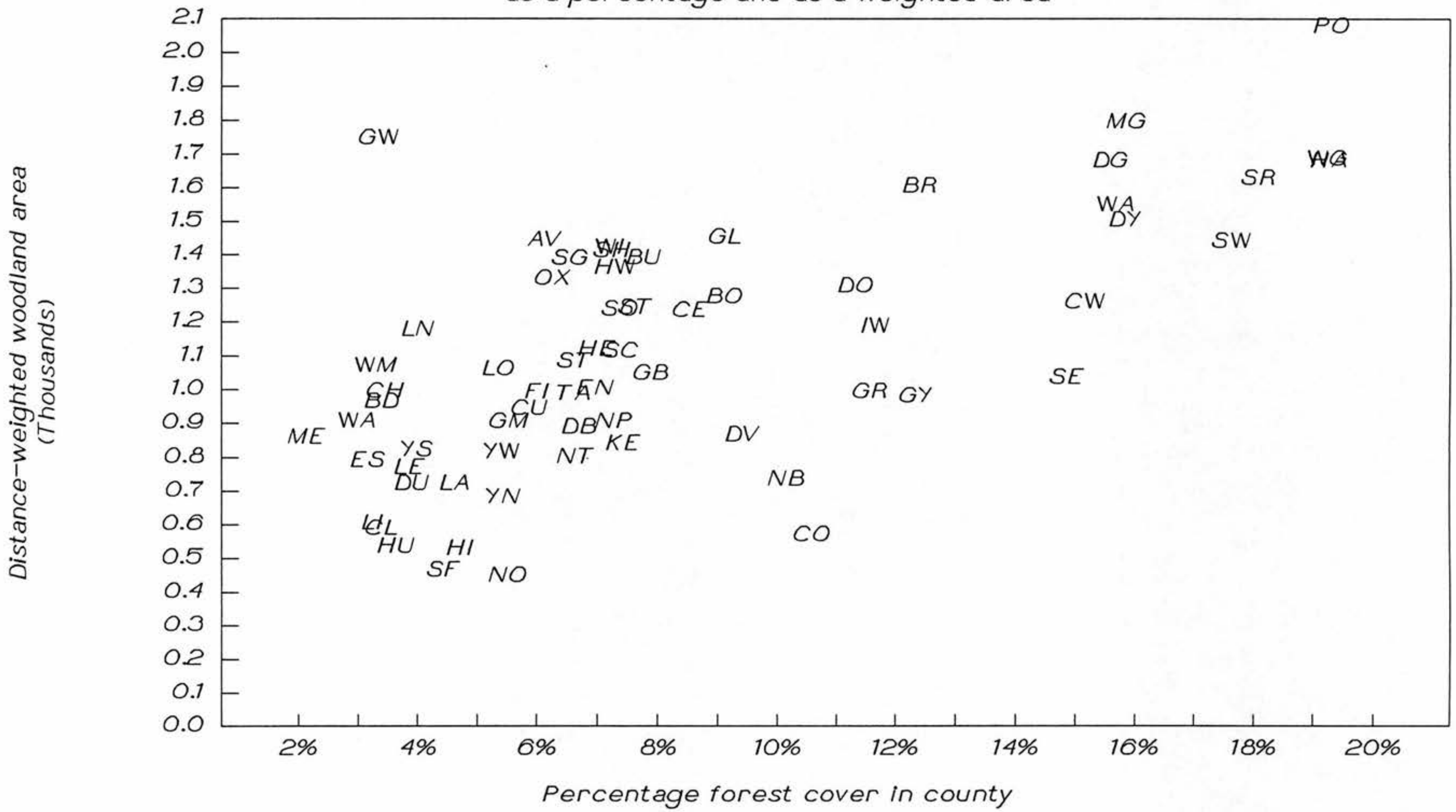
# Fig. 4.3.4 Comparison of satellite data

as a percentage and as area within 50km



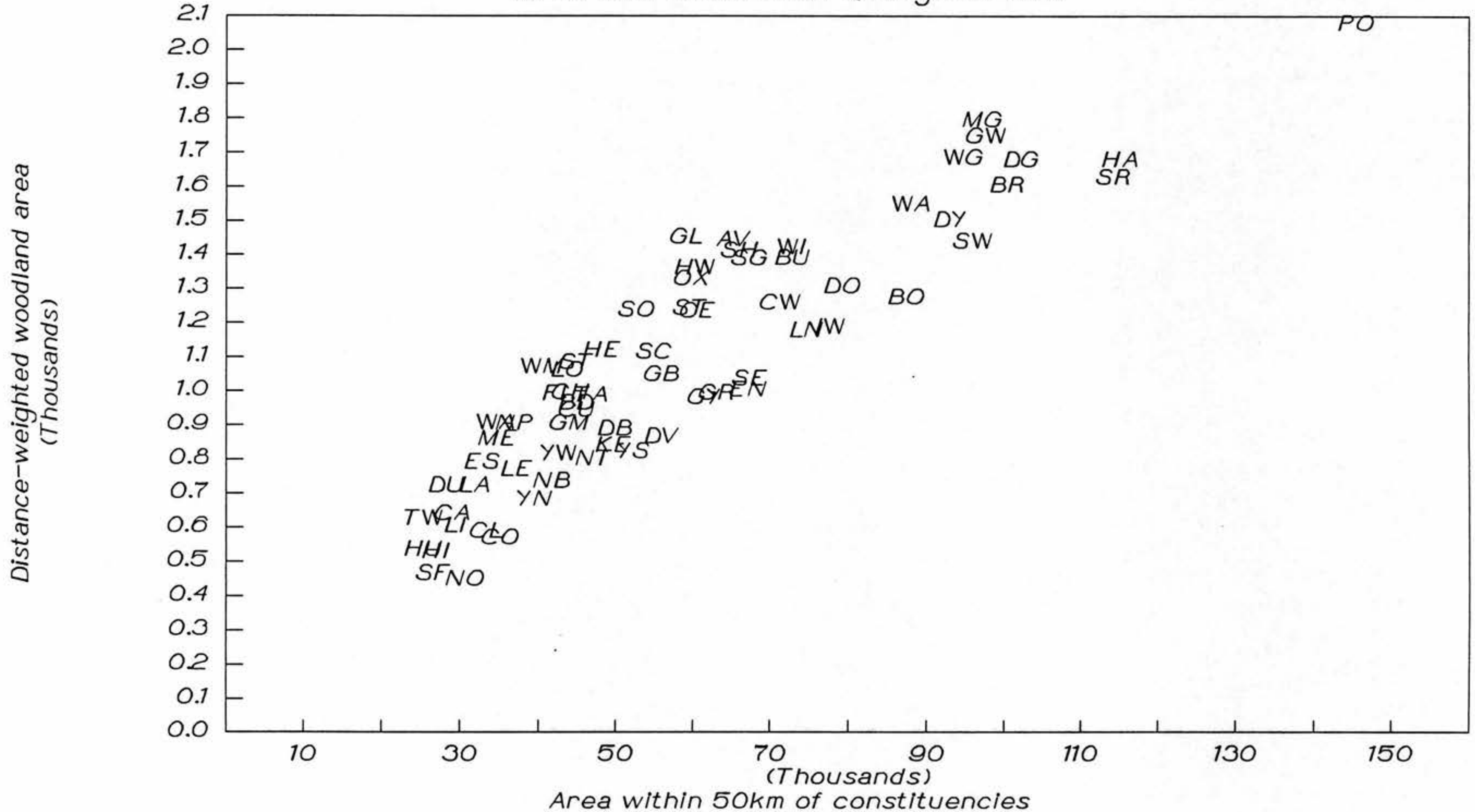
# Fig. 4.3.5 Comparison of satellite data

as a percentage and as a weighted area



# Fig. 4.3.6 Comparison of satellite data

as an area within 50km & weighted area



Conclusions

This section has discussed the sources of data available on the location of forests, the way in which the quantity of a forest (from the point of view of its recreational services) can be measured, and different ways of aggregating measures into a total measure of forest recreation supply. It has argued that the only currently feasible way of measuring forest recreation supply is to measure woodland area. All three data sources give estimates of this but the census figures are limited by only being available to a county/region level and a question mark hangs over the accuracy of the satellite woodland cover figures. The recreation database woodland figures are also possibly inaccurate for certain categories of woodland ownership, but they have the advantage of having been estimated recently and of being more appropriate as a measure of recreational woodland supply (because they only count woodland that has been reported in the visitor survey, or is promoted in some way for recreation).

Three ways of aggregating woodland were considered as alternative supply measures: calculating the percentage woodland cover within each county/region; calculating the total area within a certain distance of a fixed point; and calculating a distance-weighted area about a fixed point. An argument was developed in support of the last measure based on a theoretical probability model of the recreation choices available to individuals, and this was put forward as the most appropriate way of aggregating forest supply. The percentage woodland cover figures were also argued to be the worst measure of supply on the grounds that county boundaries are, from the point of view of forest recreation, completely arbitrary and bear no relationship to the distribution of forests or the potential interactions between population and forests.

A comparison of forest cover between counties/regions using all the different measures of forest supply and all the different data sources was given in Table 4.3.3. The arbitrary effect of county/region boundaries is shown by the difference between rankings of areas by percentage forest cover and rankings using the other two measures (using the same data set). Another interesting comparison can be made between the recreational woodland supply figures (from the forest recreation woodland database) and total woodland supply (from the census and satellite figures). This shows that in several areas (particularly densely populated areas) large proportions of the estimated total area of woodland is used for recreation. The variability in supply between areas is large however, irrespective of how this has been calculated, and suggests that supply might be a very useful variable to incorporate into any woodland recreation demand models that might be constructed.

## 4.4 MODELLING THE DEMAND FOR FOREST RECREATION

The three previous sections of this chapter have described how data on forest visitor numbers were collected in household surveys, used to estimate the total number of visitors to forests in Britain, and suggested alternative ways of measuring the supply of forests for recreation. This final section takes the analysis of the results from the surveys a stage further, and shows how they can be used to build models of recreation participation or demand.

The section starts with a discussion of the appropriate modelling techniques to use to analyse this sort of data. Models of recreation participation using the results obtained in 1989 and 1990-91 are then presented followed by a discussion of possible extensions to the basic model. The section finishes with an appraisal of the models constructed and some examples of how the models could be used for future policy analysis.

### Specification of a model of recreation demand

An outline of existing recreation demand models was given in Chapter 2. This section discusses the economic theory behind such models further and indicates the way in which such models can be estimated.

The underlying model behind most studies of recreation demand is the household production function model (Deyak and Smith, 1978; Bockstael and McConnel, 1981 and 1983; and Brown, Charbonneau and Hay, 1978). In this model, individuals purchase a vector of market inputs (z) and combine them with public resources (q) and their own time to produce recreational services measured as recreation visits (x):

$$x = f(z,q)$$

The inputs may be items such as travel services, parking charges, facility charges and other private inputs which are part of the recreation package. Assuming that the price of time is simply the wage rate (or some fraction of it), time is just a further dimension of z. The problem of choosing the optimal level of x can then be conceived as a two-stage maximisation problem. In the first stage, the individual minimises the cost of producing a given level of services:

$$c(x,r,q) = \min_{z} \{rz \mid x = (z,q)\}$$

where r is a vector of market prices for z. In the second stage, the individual maximises utility subject to the budget constraint of $y = c(x,r,q,) + p_h\ z_h$, where y is money income, $z_h$ a bundle of other Hicksian goods, and $p_h$ their prices. The problem is formally set out as:

$$\operatorname*{Max}_{x,z_h} \{u(x,z_h \mid y = c(x,r,q) + p_h z_h\}$$

and the first order condition for maximisation is:

$$L^{-1}du\ (x,z_h)/dx = dc\ (x,r,q)\ dx$$

where L is the Lagrangian multiplier associated with the utility function.

It is very difficult to collect enough data to estimate the household production function model, so most recreation demand models are reduced versions of this underlying model. For example, the travel cost model is a simplification of the utility function above, where only travel costs (including time), income, and numbers of visits are included in the maximisation problem (McConnel, 1985). Multiple-site travel cost models are a further extension of this where varying levels of q and z can be incorporated into the maximisation problem. However, with household survey data, travel costs are not known so an alternative modelling strategy must be found.

As was discussed in Chapter 2, another reduced form version of this model is one where participation in recreation activities is modelled as a function of income, population characteristics (because of the cross-sectional nature of the data) and the supply of natural resources. Participation and frequency of use can be modelled as either separate functions of these variables or jointly, depending on whether the variables affecting participation and frequency are different or the same (see Section 2.3). However, because participation is a binary (ie 1,0) variable, and frequency of use is usually also limited to only a few values, OLS regression leads to problems such as heteroskedastic errors and predictions outside the feasible range of the dependent variable which must be overcome.

The proof of this is that if:

$$\text{Prob}\ [Y = 1] = F(x, B)$$

$$\text{Prob}\ [Y = 0] = 1 - F(x, B)$$

and if OLS were used to estimate the following regression:

$$F(x,B) = B'x$$

Since $E[y] = F(x,B)$, the regression model would be:

$$\begin{aligned} y &= E[y] + (y - E[y]) \\ &= B'x + e \end{aligned}$$

But because $B'x + e$ must equal zero or one, then e equals either $B'x$ or $1 - B'x$ with probabilities 1-F, and F respectively, and it can be shown that:

$$Var[e] = B'x(1 - B'x)$$

The problem of heteroskedasticity can be overcome by using a generalised least squares method of estimation, but the problem remains that the results of a linear regression such as that described above would not be restricted to the 0,1 range observed in the data.

There are a range of models which have been developed to estimate relationships where the dependent variable is not continuous (eg binary, grouped, proportional, or categorised data) and overcome this problem. The model which is theoretically most appealing to apply to the recreation demand modelling situation is the model developed by Goldberger (1964). This assumes that there is an underlying response variable $y^*_i$ defined by the regression relationship:

$$y^*_i = B'x_i + u_i$$

The variable $y^*_i$ is unobservable and in the case of recreation demand, for example, would be net utility from making a recreation trip. What is observed in the data, however, is a dummy variable y defined as:

$y = 1$ if $y^*_i > 0$

$y = 0$ otherwise

This specification can be used therefore to model whether a visit takes place or not, dependent on the values of a set of independent variables, without actually having to measure the value of the (true) underlying dependent variable.

The model uses a cumulative probability function to transform the predictions such that as $B'x$ tends to +/- infinity, the value of y (which is transformed into a probability) tends to 1 or 0. The two most common distributions used for this purpose are the normal distribution, which is used in the probit model, or the logistic distribution used in the logit model.

The transformation of the y variable from a binary variable to a probability means that standard regression techniques can no longer be used to estimate the (probit or logit) model. Each observation can be treated, however, as a single draw from a Bernoulli distribution such that the likelihood function for the y variable can be calculated and maximised to obtain the best estimates of the regression coefficients (Greene, 1993). As usual, maximisation of the likelihood function is an iterative process, and the computer package used for the analysis of the forest visitor data (LIMDEP) used Newton's method to do this.

There is no *a priori* reason for choosing between the probit or logit models. The tails of the cumulative normal and logistic probability distribution functions are slightly different which leads to slightly different coefficients on the independent variables. However, both alternatives were used to estimate a few of the models presented later, and the results of the two alternative transformations were found not to be very different from each other. The main advantage of the logit model over the probit model is the greater ease with which the likelihood function can be calculated, but with modern computers this advantage is not significant. Because the coefficients are slightly easier to interpret in the probit model therefore, it was decided to use the probit model to estimate these relationships throughout this research.

<u>An econometric model of forest recreation demand based on the 1989 survey results</u>

As a first stage in estimating a forest recreation demand model, the following model was constructed and estimated using probit regression:

$$r = f(A,S,M,L)$$

where r equals the probability of having made a trip in the last 2 months (England and Wales) or 4 weeks (Scotland), A is a vector of age variables (actual age and age squared in England and Wales, and a set of age-group dummy variables in Scotland), S is a vector of socio-economic characteristics (sex, working status, car ownership, social class, and presence of children in the respondent's household), M is a vector of dummy variables for each of the months of the survey, and L is a vector of location specific variables. This model was estimated first for all countryside/leisure trips (ie the dependent variable was 1 if the respondent had been on a countryside/leisure trip during the recall period, or 0 otherwise), then for all trips that had also been forest trips on the last occasion. For Scotland, the model used weights in the estimation procedure based on the weighting matrix that was used to control the sample selection process. For England and Wales, a further model was also estimated for all forest trips made from home (as opposed to on holiday). The results of these estimations are shown in Tables 4.4.1 and 4.4.2.

The models reviewed in Chapter 2 indicated that age, income, and location specific (ie supply) variables should be significant in these models and that was indeed the case. The coefficients on age and age squared were significant in all three models for England and Wales, and implied increased participation up to about the age of 50 (for general countryside recreation trips) or 30 (for forest recreation trips) with participation declining thereafter (a similar relationship to that found in Vaughan and Russel, 1982 and Cichetti, 1973). The results from Scotland were slightly different because actual age was not recorded in the survey so dummy variables representing different age groups had to be used in the model. These showed participation to be a declining function of age in the case of all leisure outings (the baseline group against which these dummies were measured was the 15-17 age group). In the case of forest trips the effect of age on participation was less pronounced; the results showed participation to be slightly higher in the two age groups covering the age range 25-44 then falling thereafter (similar to the results in England and Wales) and the only significant coefficient was on the over 64 age group, which showed a much lower participation rate than the others.

Table 4.4.1 Results of probit estimation of recreation demand functions using results of the household surveys from England and Wales in 1989

| Dependent variable: | Been on a countryside outing in last 2 months | | Been on a countryside outing in last 2 months and went to a forest on last occasion | | Been on a countryside outing in last 2 months and went to a forest from home on last occasion | |
|---|---|---|---|---|---|---|
| Independent variables | Coefficient | t-statistic | Coefficient | t-statistic | Coefficient | t-statistic |
| Constant | -1.4676 | -20.77 | -2.0716 | -20.22 | -1.8560 | -14.11 |
| Socio-economic variables | | | | | | |
| Age of respondent | 0.0206 | 7.26 | 0.0126 | 2.92 | 0.0117 | 2.01 |
| $Age^2$ | -0.0002 | -7.93 | -0.0002 | -4.12 | -0.0002 | -2.77 |
| Socio-economic dummies | | | | | | |
| Male | 0.0637 | 2.98 | 0.1171 | 3.79 | 0.0954 | 2.24 |
| In full-time work | 0.0330 | 1.28 | 0.0144 | 0.40 | 0.0231 | 0.47 |
| In part-time work | 0.0622 | 1.89 | -0.0085 | -0.19 | -0.0175 | -0.27 |
| Car owner | 0.4359 | 17.95 | 0.2967 | 7.81 | 0.2757 | 5.26 |
| Social class A | 0.5179 | 6.25 | 0.2361 | 2.07 | 0.0440 | 0.27 |
| Social class B | 0.5313 | 15.51 | 0.3629 | 7.60 | 0.2359 | 3.57 |
| Social class C1 | 0.3862 | 13.91 | 0.3221 | 7.85 | 0.2289 | 4.07 |
| Social class C2 | 0.1313 | 5.11 | 0.1793 | 4.55 | 0.1226 | 2.27 |
| Has children under 3 in household | -0.0276 | -1.13 | -0.0173 | -0.52 | -0.0154 | -0.34 |
| Has children aged 3-5 in household | 0.0178 | 0.75 | 0.0291 | 0.96 | 0.0581 | 1.48 |
| Has children aged 6-9 in household | 0.0456 | 2.22 | 0.1021 | 4.02 | 0.0919 | 2.63 |
| Has children aged 10-15 in household | -0.0521 | -3.12 | 0.0378 | 1.77 | 0.0696 | 2.48 |
| Seasonal dummies | | | | | | |
| Jan-Feb 89 | -0.0144 | -0.34 | -0.0341 | -0.55 | NA | NA |
| Feb-Mar 89 | 0.1886 | 4.42 | 0.0063 | 0.10 | NA | NA |
| Mar-Apr 89 | 0.3580 | 8.59 | 0.1090 | 1.83 | NA | NA |
| Apr-May 89 | 0.4974 | 11.92 | 0.2298 | 3.95 | NA | NA |
| May-Jun 89 | 0.5656 | 13.79 | 0.1558 | 2.67 | -0.1026 | -1.80 |
| Jun-Jul 89 | 0.5549 | 13.22 | 0.1356 | 2.27 | -0.1329 | -2.26 |
| Jul-Aug 89 | 0.7089 | 17.47 | 0.0940 | 1.61 | -0.1417 | -2.50 |
| Sep-Oct 89 | 0.4100 | 9.52 | 0.0650 | 1.04 | -0.2005 | -3.24 |
| Locational dummy | | | | | | |
| Lives in urban constituency | -0.0619 | -3.19 | -0.0574 | -2.08 | -0.0774 | -2.03 |
| Number of observations | | 18687 | | 18687 | | 10432 |
| Test statistics | | | | | | |
| Log-likelihood | | -11597 | | -5067 | | -2623 |
| Restricted log-likelihood | | -12696 | | -5338 | | -2732 |
| Chi-squared | | 2199 | | 542 | | 218 |
| Aldrich & Nelson's $R^2$ (normalised) | | 0.183 | | 0.078 | | 0.060 |
| Table of predicted outcomes from | Predicted | | Predicted | | Predicted | |
| the model against actual outcomes | 0 | 1 | 0 | 1 | 0 | 1 |
| Actual 0 | 8336 | 2552 | 17117 | 22 | 9630 | 38 |
| 1 | 3972 | 3827 | 0 | 1548 | 0 | 764 |
| Proportion of correct predictions | | 0.651 | | 0.999 | | 0.996 |
| Goodman & Kruskal's $R^2$ | | 0.163 | | 0.986 | | 0.950 |

| Table 4.4.2 Results of probit estimation of recreation demand functions using results of the household surveys from Scotland in 1989 | | | | |
|---|---|---|---|---|
| Dependent variable: | Been on a leisure outing in last 4 weeks | | Been on a leisure outing in last 4 weeks and went to forest on last occasion | |
| Independent variables | Coefficient | t-statistic | Coefficient | t-statistic |
| Constant | −0.1502 | −1.87 | −2.3246 | −16.54 |
| Age dummies | | | | |
| Age 18–24 | −0.2284 | −3.06 | −0.0540 | −0.50 |
| Age 25–34 | −0.2304 | −3.03 | 0.1527 | 1.43 |
| Age 35–44 | −0.3771 | −5.04 | 0.1274 | 1.22 |
| Age 45–54 | −0.6021 | −8.13 | −0.0490 | −0.46 |
| Age 55–64 | −0.6280 | −8.27 | −0.1320 | −1.18 |
| Age over 64 | −0.7857 | −10.41 | −0.3344 | −2.96 |
| Socio-economic dummies | | | | |
| Male | 0.1858 | 5.92 | 0.0611 | 1.26 |
| In full-time work | 0.0103 | 0.27 | −0.0407 | −0.72 |
| In part-time work | 0.0931 | 1.86 | 0.0503 | 0.70 |
| Social class AB | 0.7567 | 17.22 | 0.3789 | 6.05 |
| Social class C1 | 0.4867 | 12.76 | 0.2400 | 4.05 |
| Social class C2 | 0.3054 | 8.66 | 0.2377 | 4.29 |
| Has children under 5 in household | −0.0995 | −2.25 | −0.0233 | −0.37 |
| Has children aged 5–9 in household | 0.1292 | 2.90 | 0.1374 | 2.31 |
| Has children aged 10–14 in household | −0.0282 | −0.64 | 0.0555 | 0.91 |
| Seasonal dummies | | | | |
| Feb 89 | 0.1149 | 1.98 | 0.3364 | 2.76 |
| Mar 89 | 0.2790 | 4.81 | 0.9641 | 8.77 |
| Apr 89 | 0.4706 | 8.07 | 0.5821 | 5.04 |
| May 89 | 0.4904 | 8.25 | 1.2890 | 12.02 |
| Jun 89 | 0.5964 | 10.15 | 0.5232 | 4.48 |
| Jul 89 | 0.6982 | 11.83 | 0.7702 | 6.86 |
| Aug 89 | 0.3407 | 5.87 | 0.4619 | 3.80 |
| Oct 89 | 0.1447 | 2.50 | 0.3791 | 3.14 |
| Number of observations | | 8981 | | 8981 |
| Test statistics | | | | |
| Log-likelihood | | −5665 | | −2173 |
| Restricted log-likelihood | | −6152 | | −2495 |
| Chi-squared | | 972 | | 644 |
| Aldrich & Nelson's $R^2$ (normalised) | | 0.169 | | 0.187 |
| Table of predicted outcomes from the model against actual outcomes | Predicted | | Predicted | |
| | 0 | 1 | 0 | 1 |
| Actual 0 | 1943 | 1974 | 8232 | 34 |
| 1 | 1163 | 3901 | 0 | 715 |
| Proportion of correct predictions | | 0.651 | | 0.996 |
| Goodman & Kruskal's $R^2$ | | 0.199 | | 0.952 |

A major fault with the data, from the point of view of constructing a model of recreation demand based on economic theory, was the fact that the surveys had not collected any income data. Two variables were collected that might be suitable proxies for income - working status of the respondent and social class - but the coefficients on these variables gave mixed signals as to either whether they were good proxies for income, or whether (if they were) income had the expected effect on participation.

The coefficients on working status had the correct (ie positive) sign in the general recreation demand models if these variables were acting as a proxy for income. However, the coefficient on part-time working was greater than that for full-time working in several cases and in the forest recreation models some of the coefficients were negative which would not be expected. Also neither of the coefficients were significant at the 5% confidence level in any of the models. This suggested that the variables were probably not a good proxy for income possibly because they contained information about the amount of leisure time available to the respondent which would also affect participation.

Social class was a slightly better proxy for income. It was generally significant in all the models, had the correct sign, and the coefficients on each of the social class dummies were generally ranked in the correct order if this were acting as a proxy for income (social class DE was taken as the baseline, ie no dummy variable situation). The only exception to this was the highest social class (A) in the forest recreation demand model for England and Wales which appeared to have a lower effect on participation than the other social class dummies.

The use of social class as a proxy for income was thought to be problematical for several reasons. Social class is based on occupation but this may not in all circumstances reflect income. For example, some professions such as teaching come above others such as building trades in the social class scale, but in terms of income these two occupations could be ranked the other way round. Secondly, as with the working status variable, the amount of leisure time available may vary between occupations which would confound the results. It would be expected that in occupations registering a higher social class entitlement to holidays will be generally higher (although entitlements are not always fully taken, particularly in some occupations) and as Harrison (1991) shows the increased availability of leisure time has been a major factor behind the increase in recreation over the last few decades. So, not having an estimate of how much leisure time respondents had was an important omission from the data set which made it difficult to interpret these results. Finally, it was felt that other socio-economic variables such as levels of education, tastes and age may also be correlated with social class. Because they may affect recreation participation in a different way to income, they may further reduce the value of social class as a proxy for income, but may make it more interesting as a variable in its own right.

Given that income data was not available from the survey, there was no choice but to use social class as an explanatory variable in the models. Social classes A and B appeared to have the highest participation rates in most of the models except the model of forest recreation demand in England and Wales, followed by C1, C2, and then social class DE, the base line against which these dummy variables were measured. Whether this was a reflection of income or other effects is not known. It was suspected that income could be a major factor underlying these results but that other factors such as leisure time availability, tastes and education may also be captured in the coefficients on the social class dummy variables.

The only location-specific variable that was included in these preliminary models was a dummy variable representing whether the respondent had come from an urban parliamentary constituency in England and Wales. This took a significant negative value in all the models indicating that respondents in urban constituencies were significantly less likely to have participated in countryside and forest recreation trips than those living elsewhere, and was a first crude indication of the effect that supply might have on participation.

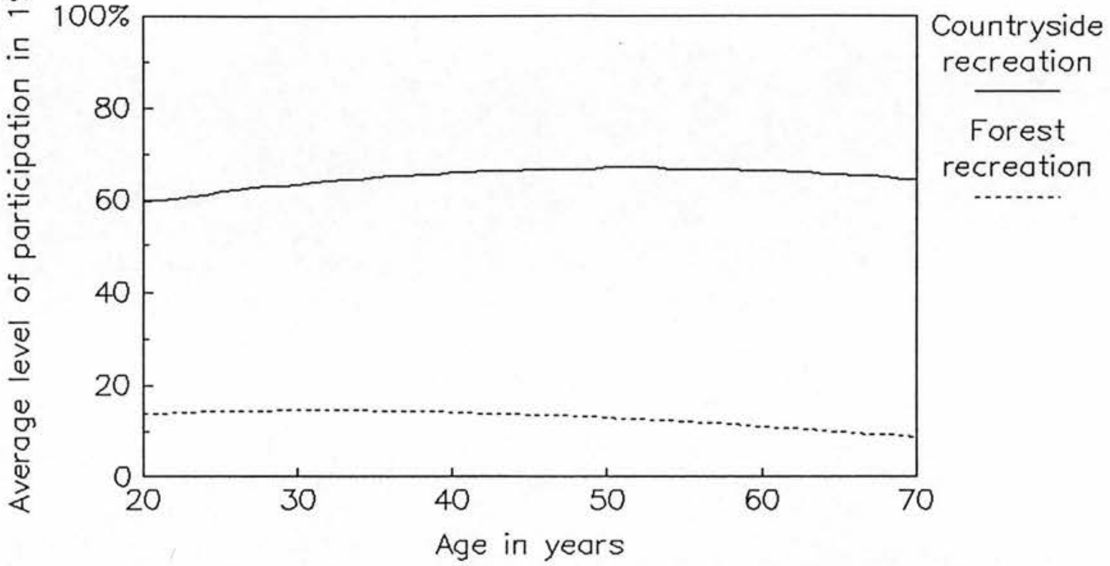
Most of the other socio-economic variables that were included in the models - car ownership, sex and presence of children in the household - had some effect on participation. Car ownership, which was only collected in England and Wales, had a strong positive effect on participation in all the demand models. This variable has been found to be significant before in demand models constructed for travel-cost analysis (eg Willis *et al*, 1989). Sex was also found to be generally significant, with men participating more than women in all the demand models. An interesting result with respect to this variable was that men had a much higher participation rate than women in leisure outings in Scotland compared to the difference between men and women's participation rates in countryside outings in England and Wales. It was suspected that this was because the definition of leisure outings used in Scotland included activities popular with men such as going to watch sport and going out to pubs. The effect of children in the household on participation was mixed. The presence of children in the youngest age group tended to reduce participation in all the models while children in the age group 6-9 (in England and Wales) or 5-9 (in Scotland) tended to increase it (above the participation rate of households with no children at all). The latter effect was significant in all the models as well. The presence of children in the highest age group had an unusual effect in that it reduced participation in general countryside recreation or leisure trips, but increased it in forest trips (although this was only significant in the models for England and Wales).

Seasonal dummy variables were significant in all the models except for some of the earlier and later months in 1989 in England and Wales. The baseline against which these dummy variables were measured was the period November/December 1988 in England and Wales and December 1989 in Scotland. In the model of forest visits from home, the baseline was results from the period April/May 1989 because data was not collected to enable visits from home to be identified before this period. The results for May/June 1989 were not significantly different to the results from April/May in this model. It was not surprising that the results showed seasonal variation because the weather experienced at different times during the year will make recreation more or less attractive. The results may also reflect the availability of leisure time during different periods due to factors such as public and trades holidays. What was most interesting, however, was the way that the seasonal patterns were different between Scotland and England/Wales and between forest recreation and general recreation trips. As has been noted earlier in this chapter, the results for forest visits in Scotland during March and May 1989 should be treated with caution because it was thought they were unrealistically high and had been brought about by changes in the survey design.

In order to illuminate these results, it is possible to plot the marginal effect of one of the variables on participation, and this is done in Figures 4.4.1 to 4.4.4. Participation is calculated by taking the predicted y values from the probit regression and transforming them back into probabilities of making a visit using the cumulative normal distribution. The figures show, for both England/Wales and Scotland, the effect of age and the seasonal effect on participation in countryside recreation/leisure and forest outings. The figures also show quite clearly the differences between the variables in terms of their effect on participation in forest outings and all types of outing.

The models were all significant in that the Chi-squared statistic calculated from the log-likelihood function was significant in all cases. It is usual however, to also appraise the results of models in terms of their goodness of fit. This is difficult in the case of limited dependent variable models though because the results of the estimation procedure are probabilities lying between 0 and 1 for each of the observations, while the observations of the dependent variable take on discrete values of 1 or 0. Two groups of measures are most commonly calculated as pseudo-$R^2$ statistics for this purpose: measures based on the log-likelihood results for the model, and measures based on a table of actual predicted results from the model, and these were also calculated as part of the estimation procedure.

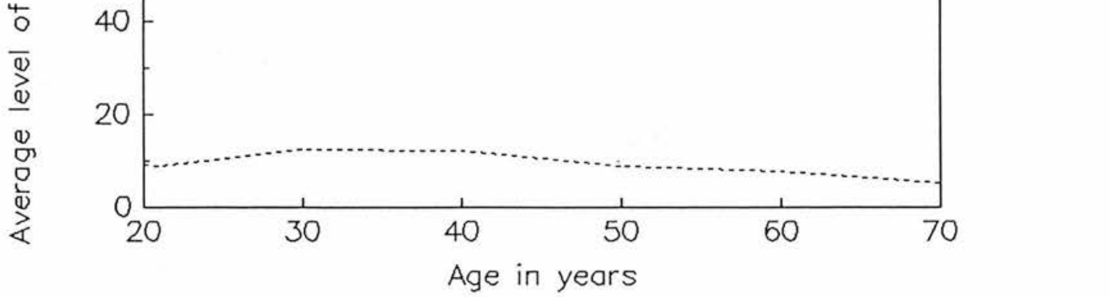
## Figure 4.4.1 The effect of age on participation in countryside and forest recreation in England and Wales




Note: Other variables in the model are set so as to represent a male, car owner, social class B, with no children, living in an urban location

Participation is defined as having been on a visit lasting more than three hours total duration in the last two months

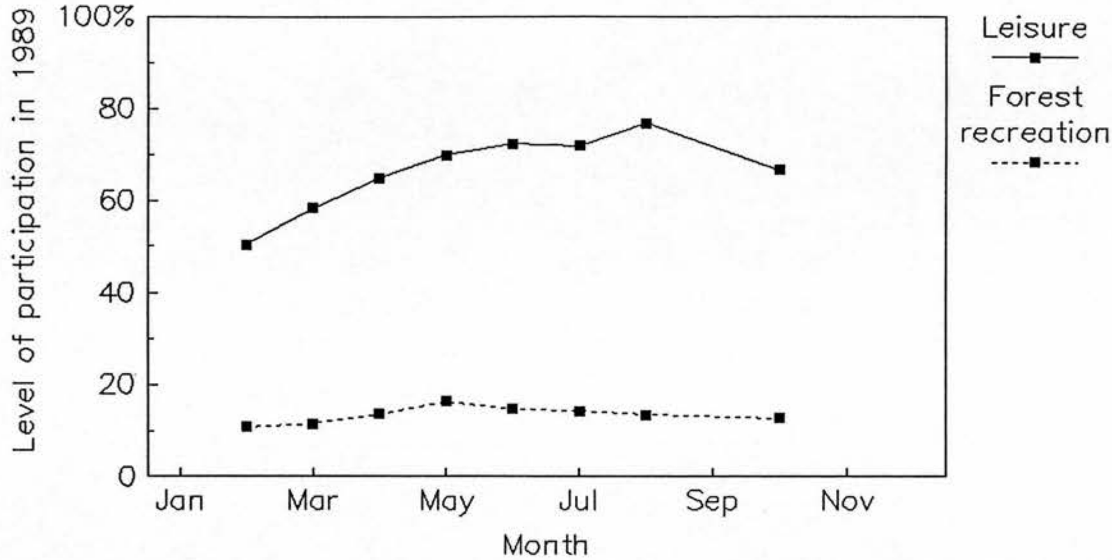
## Figure 4.4.2 The effect of age on participation in leisure and forest recreation in Scotland




Note: Other variables in the model are set so as to represent a male, social class AB, with no children

Participation is defined as having been on a visit lasting more than three hours total duration in the last four weeks

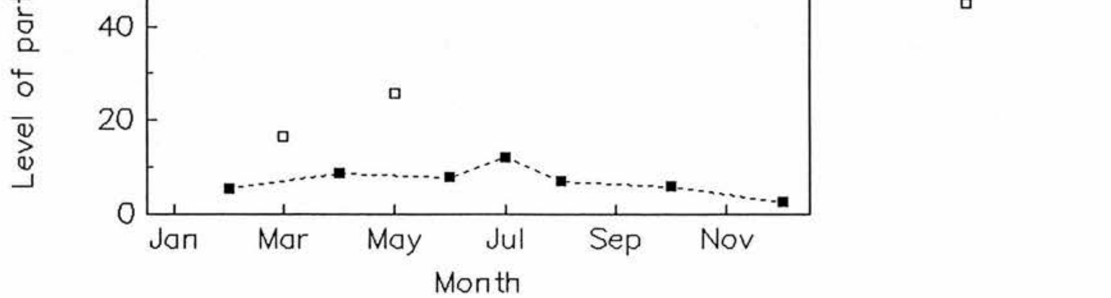
## Figure 4.4.3 The monthly variation in participation in countryside and forest recreation in England and Wales




Note: Other variables in the model are set so as to represent a male, car owner, social class B, average age, with no children, in an urban area

Participation is defined as having been on a visit lasting more than three hours total duration in the last two months

## Figure 4.4.4 The monthly variation in participation in leisure and forest recreation in Scotland




Note: Other variables in the model are set so as to represent a male, social class AB, average age, with no children

Participation is defined as having been on a visit lasting more than three hours total duration in the last four weeks

Veall and Zimmermann (1994) review a wide range of pseudo-$R^2$ statistics for limited dependent variable models including those suggested by Aldrich and Nelson (1984), McFadden (1973), McKelvey and Zavoina (1975) and Goodman and Kruskal (1954). All the pseudo-$R^2$ statistics from the models were low, but this is not necessarily an indicator of poor models because this is often the case in limited dependent variable models, particularly when there is an unbalanced number of 1s and 0s in the data set. They could not therefore be used in the conventional sense as an appraisal of the models, but could be used to compare different specifications of the models.

Veall and Zimmerman show that the Aldrich and Nelson pseudo-$R^2$ statistic (which is based on the restricted and unrestricted log-likelihood results) generally has an upper limit of less than 1 and suggest a normalisation to account for this. This was chosen as the pseudo-$R^2$ statistic to compare between models and using this measure, the models of total recreation demand had pseudo-$R^2$ of 17-18% and the models of forest recreation demand a pseudo-$R^2$ of 6-8% in England/Wales and 10% in Scotland. The McFadden pseudo-$R^2$ (also based on the log-likelihood results), and McKelvey and Zavoina pseudo-$R^2$ (which is calculated as the proportion of explained to total variation in a similar way to a conventional $R^2$) were both lower than this in all cases.

As an alternative to these measures, a table of actual and predicted 1s and 0s can also be calculated. Conventionally, a 1 is usually predicted for each observation where the regression results give $p(y=1)>0.5$. However, as Green (1993) points out, if the sample is unbalanced, it may require an extreme combination of regressors to predict even a $p(y=1)$ of 0.2 let alone 0.5. This was the case in these models, and none of the models of forest recreation demand predicted any 1s using the p(y=1)>0.5 rule. As this was not a very helpful statistic to compare between models, a range of tables were generated using different "hurdle" probabilities and it was found that when the probability was lowered such that the table gave a prediction of 1 when p(y=1)>0.4 the tables showed much higher levels of correct predictions. This was therefore calculated and is shown in all the tables of results. The Goodman and Kruskall pseudo-$R^2$ compares the proportion of correct predictions from this table to a naive prediction (that all predictions are the same as the most common outcome) and is also shown in the tables of results.

It was disappointing that adequate $R^2$ measures could not be calculated for these models to give an accurate and easily interpretable measure of the goodness of fit of the models. The models were all significant, in terms of their likelihood ratios, and the t-statistics on many of the individual variables were significant. However, it was not possible to calculate conventional measures of how useful the models were in terms of explanatory power. Pseudo-$R^2$ statistics were used to compare the models with each other when additional supply variables were added, but the very low values for all the pseudo-$R^2$ statistics could not be given the usual interpretation that the models had low explanatory power because this is always the case where the dependent variable is only 1 or 0 but the predicted value is a continuous variable between 1 and 0.

Having constructed models of recreation demand based on age and socio-economic variables, the next stage in the modelling process was then to incorporate different supply variables into the models to see which if any of these had a significant effect on participation. The first supply variable that was tried was percentage forest cover in the respondents' home county/region calculated from each of the three data sources. This was the only supply variable available for Scotland because the home location of each respondent could only be identified to the level of the local authority region.

In the models for England and Wales, forest trips from a holiday base were excluded from the analysis because the supply at holiday locations would be different to the supply from home in most cases. This also required the sample to be reduced to the last 5 monthly samples of results (as noted before) because this distinction had not been made in the earlier surveys. This distinction could not be made for any of the responses in Scotland because visits from home were not separately identified in the data. This may, therefore, have led to measurement error in the models constructed from the Scottish data. In England and Wales, dummy variables were also added for the metropolitan counties because of their small size which it was felt, might lead to different results than for other counties. The results of the six models estimated for England/Wales and Scotland are shown in Tables 4.4.3 and 4.4.4.

The results for England/Wales showed that the inclusion of a supply variable had little effect on the coefficients or significance of the other variables in the model except the urban location dummy which was reduced and became insignificant at the 5% level. This could have been in part due to multi-collinearity with the other location dummies. In the models using a total forest supply variable (ie based on census or satellite data) the only metropolitan county which showed a level of

Table 4.4.3 Results of probit estimation of forest recreation demand functions using results of the household surveys from England and Wales in 1989 and incorporating supply variables (percentage forest cover) into the analysis

Dependent variable: Been on a countryside outing in the last two months and visited a forest from home on the last occasion

| Data source for supply variable | Census | | Satellite | | Forest rec. database | |
|---|---|---|---|---|---|---|
| Independent variables | Coefficient | t-statistic | Coefficient | t-statistic | Coefficient | t-statistic |
| Constant | -2.0504 | -14.95 | -2.0444 | -15.01 | -1.9866 | -14.86 |
| Socio-economic variables | | | | | | |
| Age of respondent | 0.0121 | 2.08 | 0.0121 | 2.07 | 0.0115 | 1.96 |
| $Age^2$ | -0.0002 | -2.88 | -0.0002 | -2.90 | -0.0002 | -2.75 |
| Socio-economic dummies | | | | | | |
| Male | 0.0916 | 2.14 | 0.0964 | 2.25 | 0.0890 | 2.07 |
| In full-time work | 0.0308 | 0.62 | 0.0266 | 0.53 | 0.0284 | 0.57 |
| In part-time work | -0.0259 | -0.40 | -0.0274 | -0.43 | -0.0311 | -0.48 |
| Car owner | 0.2708 | 5.13 | 0.2666 | 5.05 | 0.2717 | 5.14 |
| Social class A | 0.0549 | 0.33 | 0.0633 | 0.39 | 0.0413 | 0.25 |
| Social class B | 0.2427 | 3.64 | 0.2429 | 3.64 | 0.2360 | 3.54 |
| Social class C1 | 0.2284 | 4.04 | 0.2261 | 3.99 | 0.2193 | 3.87 |
| Social class C2 | 0.1241 | 2.28 | 0.1222 | 2.25 | 0.1173 | 2.15 |
| Has children under 3 in household | -0.0174 | -0.38 | -0.0171 | -0.37 | -0.0206 | -0.45 |
| Has children aged 3-5 in household | 0.0565 | 1.44 | 0.0552 | 1.40 | 0.0571 | 1.45 |
| Has children aged 6-9 in household | 0.0906 | 2.58 | 0.0898 | 2.56 | 0.0888 | 2.53 |
| Has children aged 10-15 in household | 0.0689 | 2.44 | 0.0695 | 2.46 | 0.0681 | 2.41 |
| Seasonal dummies | | | | | | |
| May-Jun 89 | -0.1035 | -1.81 | -0.1016 | -1.77 | -0.0940 | -1.64 |
| Jun-Jul 89 | -0.1266 | -2.14 | -0.1269 | -2.14 | -0.1354 | -2.28 |
| Jul-Aug 89 | -0.1356 | -2.38 | -0.1344 | -2.36 | -0.1288 | -2.26 |
| Sep-Oct 89 | -0.1937 | -3.11 | -0.1913 | -3.07 | -0.1987 | -3.19 |
| Locational dummies | | | | | | |
| Lives in urban constituency | -0.0559 | -1.26 | -0.0518 | -1.17 | -0.0441 | -1.00 |
| Greater London | 0.0044 | 0.06 | -0.0025 | -0.03 | -0.1900 | -2.44 |
| West Midlands | 0.0169 | 0.17 | -0.0180 | -0.19 | -0.0846 | -0.90 |
| Tyneside | 0.2054 | 1.84 | 0.2313 | 2.07 | 0.1659 | 1.51 |
| Merseyside/Greater Manchester | 0.0944 | 1.24 | 0.0487 | 0.67 | 0.0234 | 0.33 |
| Supply variable | | | | | | |
| Percentage woodland cover in county | 2.5080 | 5.46 | 2.5156 | 5.99 | 6.7027 | 6.99 |
| Number of observations | | 10432 | | 10432 | | 10432 |
| Test statistics | | | | | | |
| Log-likelihood | | -2607 | | -2604 | | -2598 |
| Restricted log-likelihood | | -2733 | | -2733 | | -2733 |
| Chi-squared | | 252 | | 258 | | 269 |
| Aldrich & Nelson's $R^2$ (normalised) | | 0.069 | | 0.070 | | 0.073 |
| Table of predicted outcomes from | Predicted | | Predicted | | Predicted | |
| the model against actual outcomes | 0 | 1 | 0 | 1 | 0 | 1 |
| Actual 0 | 9666 | 2 | 9668 | 0 | 9666 | 2 |
| 1 | 0 | 764 | 0 | 764 | 0 | 764 |
| Proportion of correct predictions | | 1.000 | | 1.000 | | 1.000 |
| Goodman & Kruskal's $R^2$ | | 0.997 | | 1.000 | | 0.997 |

Table 4.4.4 Results of probit estimation of forest recreation demand functions using results of the household surveys from Scotland in 1989 and incorporating supply variables (percentage forest cover) into the analysis

Dependent variable: Been on a leisure outing in the last four weeks and visited a forest on the last occasion

| Data source for supply variable | Census | | Satellite | | Forest rec. database | |
|---|---|---|---|---|---|---|
| Independent variables | Coefficient | t-statistic | Coefficient | t-statistic | Coefficient | t-statistic |
| Constant | -2.5359 | -15.40 | -2.5295 | -16.14 | -2.3468 | -16.29 |
| Age dummies | | | | | | |
| Age 18-24 | -0.0504 | -0.47 | -0.0568 | -0.52 | -0.0504 | -0.47 |
| Age 25-34 | 0.1532 | 1.43 | 0.1496 | 1.40 | 0.1560 | 1.46 |
| Age 35-44 | 0.1283 | 1.22 | 0.1254 | 1.20 | 0.1296 | 1.24 |
| Age 45-54 | -0.0553 | -0.52 | -0.0561 | -0.52 | -0.0525 | -0.49 |
| Age 55-64 | -0.1315 | -1.18 | -0.1338 | -1.20 | -0.1290 | -1.16 |
| Age over 64 | -0.3289 | -2.90 | -0.3334 | -2.95 | -0.3309 | -2.93 |
| Socio-economic dummies | | | | | | |
| Male | 0.0599 | 1.24 | 0.0600 | 1.24 | 0.0608 | 1.25 |
| In full-time work | -0.0402 | -0.71 | -0.0411 | -0.72 | -0.0407 | -0.72 |
| In part-time work | 0.0443 | 0.62 | 0.0381 | 0.53 | 0.0442 | 0.62 |
| Social class AB | 0.3869 | 6.17 | 0.3864 | 6.16 | 0.3817 | 6.09 |
| Social class C1 | 0.2426 | 4.08 | 0.2393 | 4.03 | 0.2379 | 4.01 |
| Social class C2 | 0.2398 | 4.32 | 0.2379 | 4.28 | 0.2385 | 4.30 |
| Has children under 5 in household | -0.0239 | -0.38 | -0.0218 | -0.35 | -0.0236 | -0.38 |
| Has children aged 5-9 in household | 0.1378 | 2.31 | 0.1421 | 2.39 | 0.1378 | 2.31 |
| Has children aged 10-14 in household | 0.0572 | 0.93 | 0.0571 | 0.93 | 0.0559 | 0.91 |
| Seasonal dummies | | | | | | |
| Feb 89 | 0.3290 | 2.69 | 0.3199 | 2.62 | 0.3325 | 2.72 |
| Mar 89 | 0.9522 | 8.65 | 0.9463 | 8.61 | 0.9603 | 8.73 |
| Apr 89 | 0.5781 | 5.00 | 0.5769 | 4.99 | 0.5782 | 5.00 |
| May 89 | 1.2778 | 11.90 | 1.2767 | 11.91 | 1.2638 | 11.94 |
| Jun 89 | 0.5193 | 4.44 | 0.5143 | 4.40 | 0.5219 | 4.46 |
| Jul 89 | 0.7572 | 6.73 | 0.7490 | 6.66 | 0.7612 | 6.76 |
| Aug 89 | 0.4463 | 3.76 | 0.4416 | 3.72 | 0.4474 | 3.76 |
| Oct 89 | 0.3744 | 3.10 | 0.3731 | 3.09 | 0.3776 | 3.13 |
| Supply variable | | | | | | |
| Percentage woodland cover in region | 1.3507 | 2.53 | 2.8820 | 3.05 | 0.8629 | 0.76 |
| Number of observations | | 8976 | | 8976 | | 8976 |
| Test statistics | | | | | | |
| Log-likelihood | | -2167 | | -2166 | | -2170 |
| Restricted log-likelihood | | -2493 | | -2493 | | -2493 |
| Chi-squared | | 650 | | 653 | | 645 |
| Aldrich & Nelson's $R^2$ (normalised) | | 0.190 | | 0.190 | | 0.188 |
| Table of predicted outcomes from | Predicted | | Predicted | | Predicted | |
| the model against actual outcomes | 0 | 1 | 0 | 1 | 0 | 1 |
| Actual 0 | 8262 | 0 | 8252 | 10 | 8256 | 6 |
| 1 | 0 | 714 | 0 | 714 | 0 | 714 |
| Proportion of correct predictions | | 1.000 | | 0.999 | | 0.999 |
| Goodman & Kruskal's $R^2$ | | 1.000 | | 0.986 | | 0.992 |

participation significantly different to what the models predicted elsewhere (*ceteris paribus*) was Tyneside which showed a much higher level of participation. In the model using recreational woodland supply, a slightly different result was obtained with only Greater London having a significant location dummy, which was negative. This is because, as was shown earlier, Greater London had a relatively low proportion of total woodland cover but a relatively high proportion of recreational woodland cover compared to other counties.

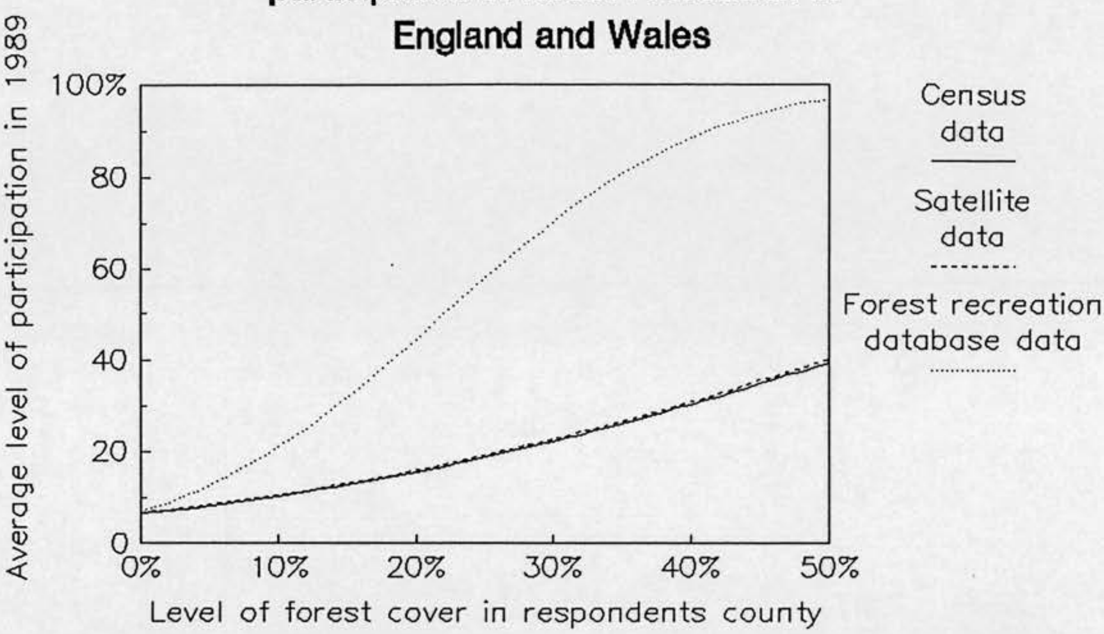
In all three models, woodland supply had a significant effect on participation. This was also reflected by higher pseudo-$R^2$ results than had earlier been obtained. The coefficients on supply were similar in the two models based on total woodland supply but the model using recreational woodland supply had a much higher coefficient because of the smaller area of woodland included in the supply variable. The most significant of the three supply variables was the percentage of recreational woodland cover, and the model containing this also had the highest pseudo-$R^2$ result of the three models which suggested that this model was slightly better than the two that were based on total woodland supply.

Similar comments to those above can be made about the results obtained from the Scottish data. The only major difference between the results obtained for Scotland compared to those for England/Wales was the value and significance of the coefficients on each of the three supply variables. The values of the coefficients on supply were very different from each other for all three supply measures. This is because (as Figure 4.3.2 showed) the differences between the satellite and census woodland cover data were very large for each of the regions in Scotland in both absolute and relative (to each other) terms, and the database of forest recreation sites there was incomplete (it contained only Forestry Commission sites). Indeed, the coefficient on recreational woodland supply was not significant in the demand model containing it. This should not necessarily be seen as an indication that this variable was *per se* unhelpful in the model, but more as an indication that it was not measured very accurately.

The fact that all three models had higher pseudo-$R^2$ statistics than the model without a supply variable, showed that the addition of a supply variable improved the goodness of fit of the models of participation in Scotland. However, the large differences in coefficients on the alternative supply variables pointed towards a problem of measurement error in the supply variable. This combined with the problem that holiday visits could not be separated out of the sample, suggested that any results obtained for Scotland were going to be only indicative of the sort of effect that supply could have on participation. The marginal effect on participation of all three supply measures in both England/Wales and Scotland was calculated as before and is shown in Figures 4.4.5 and 4.4.6.

Models were then estimated for England and Wales using the other four measures of woodland supply (area of woodland within 50 km of the respondent's home, and distance-weighted area, calculated from the satellite data and forest recreation database data). These gave similar results to the models using percentage woodland cover (see Table 4.4.5).

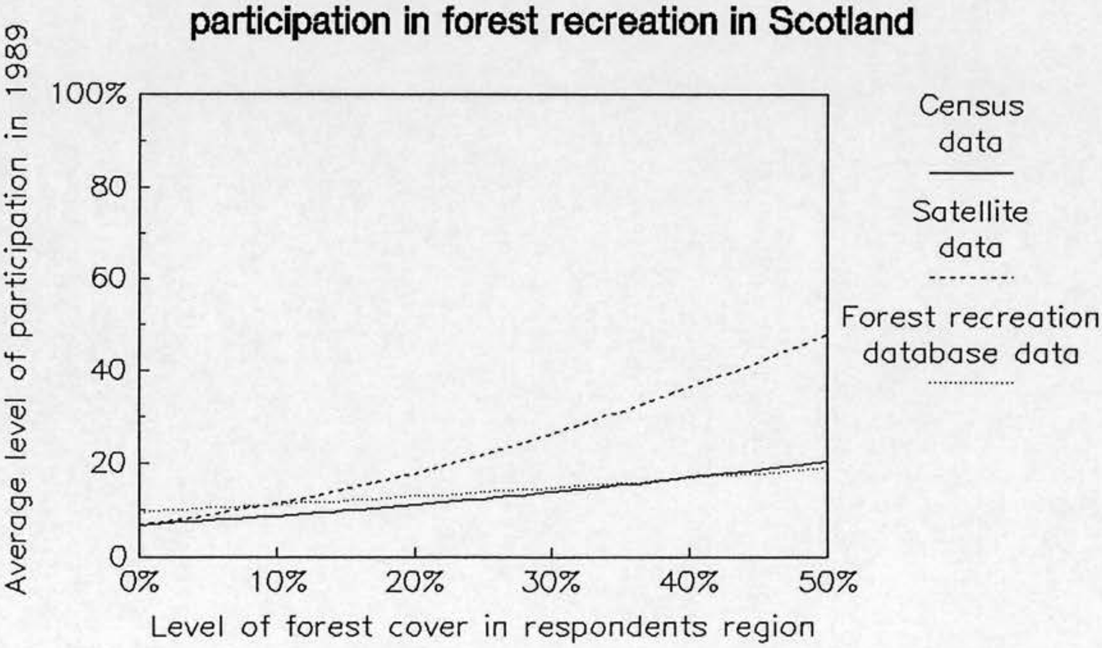
**Figure 4.4.5 The effect of woodland cover on participation in forest recreation in England and Wales**




Note: Other variables in the model are set so as to represent a male, car owner, social class B, with no children, average age, in an urban area

Participation is defined as having been on a visit lasting more than three hours total duration in the last two months

**Figure 4.4.6 The effect of woodland cover on participation in forest recreation in Scotland**




Note: Other variables in the model are set so as to represent a male, social class AB, with no children, average age

Participation is defined as having been on a visit lasting more than three hours total duration in the last four weeks

Table 4.4.5 Results of probit estimation of forest recreation demand functions using results of the household surveys from England and Wales in 1989 and incorporating supply variables (area of woodland within 50 km and distance-weighted area) into the analysis

Dependent variable: Been on a countryside outing in the last two months and visited a forest from home on the last occasion

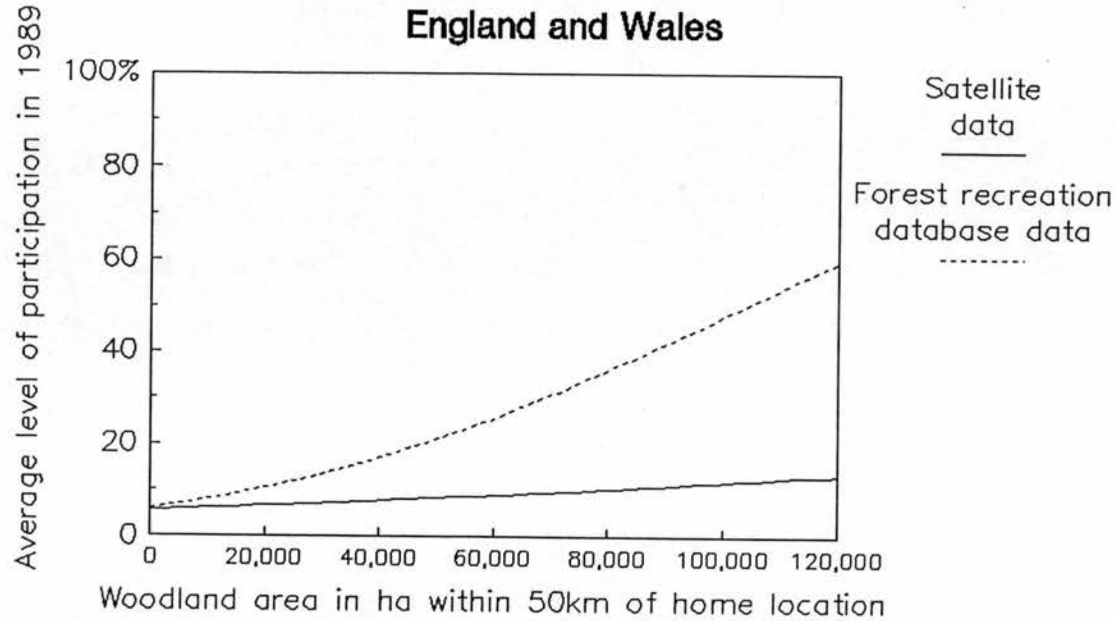
| Data source and supply variable | Woodland area within 50 km of respondents home | | | | Distance-weighted area of woodland | | | |
|---|---|---|---|---|---|---|---|---|
| | Satellite | | Forest rec. database | | Satellite | | Forest rec. database | |
| Independent variables | Coefficient | t-statistic | Coefficient | t-statistic | Coefficient | t-statistic | Coefficient | t-statistic |
| Constant | -2.0729 | -15.14 | -2.0146 | -14.98 | -2.1824 | -15.30 | -2.0984 | -15.25 |
| Socio-economic variables | | | | | | | | |
| Age of respondent | 0.0124 | 2.12 | 0.0122 | 2.09 | 0.0127 | 2.16 | 0.0126 | 2.15 |
| $Age^2$ | -0.0002 | -2.92 | -0.0002 | -2.87 | -0.0002 | -2.95 | -0.0002 | -2.93 |
| Socio-economic dummies | | | | | | | | |
| Male | 0.0951 | 2.22 | 0.0910 | 2.13 | 0.0945 | 2.20 | 0.0923 | 2.16 |
| In full-time work | 0.0197 | 0.40 | 0.0224 | 0.45 | 0.0204 | 0.41 | 0.0201 | 0.40 |
| In part-time work | -0.0294 | -0.46 | -0.0316 | -0.49 | -0.0251 | -0.39 | -0.0295 | -0.46 |
| Car owner | 0.2681 | 5.10 | 0.2680 | 5.09 | 0.2650 | 5.03 | 0.2700 | 5.13 |
| Social class A | 0.0188 | 0.11 | 0.0164 | 0.10 | 0.0211 | 0.13 | 0.0109 | 0.07 |
| Social class B | 0.2184 | 3.29 | 0.2163 | 3.26 | 0.2218 | 3.34 | 0.2124 | 3.20 |
| Social class C1 | 0.2123 | 3.75 | 0.2090 | 3.70 | 0.2198 | 3.89 | 0.2092 | 3.70 |
| Social class C2 | 0.1188 | 2.19 | 0.1150 | 2.12 | 0.1200 | 2.21 | 0.1079 | 1.99 |
| Has children under 3 in household | -0.0147 | -0.32 | -0.0165 | -0.36 | -0.0163 | -0.35 | -0.0216 | -0.47 |
| Has children aged 3-5 in household | 0.0557 | 1.42 | 0.0552 | 1.40 | 0.0548 | 1.39 | 0.0559 | 1.42 |
| Has children aged 6-9 in household | 0.0905 | 2.57 | 0.0903 | 2.56 | 0.0926 | 2.63 | 0.0913 | 2.60 |
| Has children aged 10-15 in household | 0.0736 | 2.61 | 0.0726 | 2.56 | 0.0735 | 2.60 | 0.0717 | 2.54 |
| Seasonal dummies | | | | | | | | |
| May-Jun 89 | -0.1032 | -1.81 | -0.1121 | -1.96 | -0.0981 | -1.72 | -0.0971 | -1.70 |
| Jun-Jul 89 | -0.1406 | -2.38 | -0.1461 | -2.47 | -0.1356 | -2.29 | -0.1389 | -2.35 |
| Jul-Aug 89 | -0.1475 | -2.60 | -0.1503 | -2.65 | -0.1416 | -2.49 | -0.1422 | -2.50 |
| Sep-Oct 89 | -0.2043 | -3.29 | -0.2089 | -3.36 | -0.1989 | -3.20 | -0.1960 | -3.15 |
| Locational dummy | | | | | | | | |
| Lives in urban constituency | -0.0817 | -2.14 | -0.0881 | -2.30 | -0.0659 | -1.72 | -0.0718 | -1.87 |
| Supply variable | | | | | | | | |
| Area of woodland around home location | 0.000004 | 6.20 | 0.000015 | 6.46 | 0.00003 | 6.26 | 0.0001 | 6.55 |
| Number of observations | | 10432 | | 10432 | | 10432 | | 10432 |
| Test statistics | | | | | | | | |
| Log-likelihood | | -2605 | | -2603 | | -2604 | | -2603 |
| Restricted log-likelihood | | -2733 | | -2733 | | -2733 | | -2733 |
| Chi-squared | | 256 | | 259 | | 257 | | 259 |
| Aldrich & Nelson's $R^2$ (normalised) | | 0.070 | | 0.071 | | 0.070 | | 0.071 |
| Table of predicted outcomes from | Predicted | | Predicted | | Predicted | | Predicted | |
| the model against actual outcomes | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| Actual 0 | 9668 | 0 | 9668 | 0 | 9668 | 0 | 9667 | 1 |
| 1 | 0 | 764 | 0 | 764 | 0 | 764 | 0 | 764 |
| Proportion of correct predictions | | 1.000 | | 1.000 | | 1.000 | | 1.000 |
| Goodman & Kruskal's $R^2$ | | 1.000 | | 1.000 | | 1.000 | | 0.999 |

Again, the coefficients on the socio-economic variables remained relatively unchanged from those obtained in the first models estimated without a supply variable. The coefficients on the supply variable calculated from the forest recreation database were generally more significant than those calculated from the satellite data, and the models using distance-weighted forest area were very marginally better than those using the area of woodland within 50 km. The effect of the various supply variables on participation is shown in Figures 4.4.7 and 4.4.8.

Squared supply variables were tried in all seven models in England and Wales and three models in Scotland, but were not significant in any of the models. While this indicated that only a linear relationship between supply and participation could be identified with the variability in forest cover present in the data set, it might be expected that increases in participation would decline as forest cover increased beyond a certain point. This would mean that predictions from the model should be treated with caution if the supply variable is extrapolated to a level far beyond that found in the original data set.

All the models showed that supply was a significant variable explaining participation. Comparing the three data sources, supply measures calculated from the forest recreation database were found to be more significant than the others in England and Wales. In Scotland the results were different but the degree of uncertainty about the accuracy of all of the data sources there was such that it was not possible to make anything other than a general statement that participation was likely to have been influenced by supply.

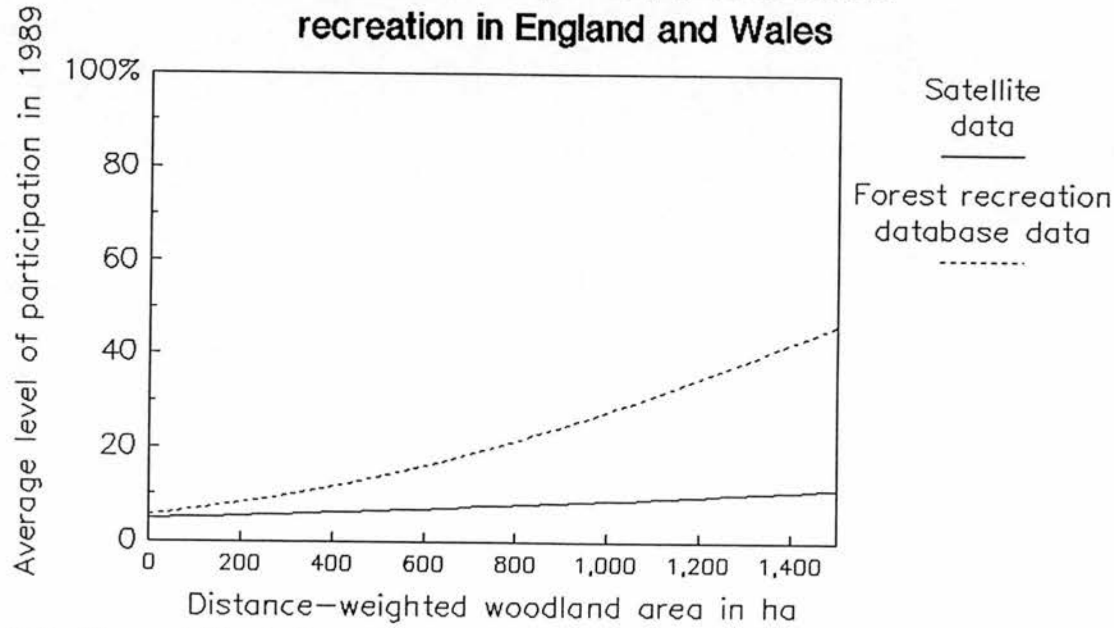
## Figure 4.4.7 The effect of woodland area on participation in forest recreation in England and Wales




Note: Other variables in the model are set so as to represent a male, car owner, social class B, with no children, average age, in an urban area

Participation is defined as having been on a visit lasting more than three hours total duration in the last two months

## Figure 4.4.8 The effect of distance-weighted woodland area on participation in forest recreation in England and Wales




Note: Other variables in the model are set so as to represent a male, car owner, social class B, with no children, average age, in an urban area

Participation is defined as having been on a visit lasting more than three hours total duration in the last two months

At face value, the results from the three different ways of calculating supply appeared to show that the proportion of woodland in a county was the best supply measure followed by distance-weighted woodland area and woodland area within 50 km. It was felt that, although the proportion woodland cover variable gave marginally better results, it was too arbitrary a variable to use in a policy or forecasting context and that the distance-weighted area should be used in preference to it. However, it was also felt that because the data set was limited to only trips over 3 hours duration (which will tend to be trips of a longer distance) all three measures were somewhat inappropriate for modelling this type of trip, and that the alternatives could not be properly judged in these particular models. This was not the case with the 1990 and 1991 data which included visits of any duration, and the results of the models calculated using these data sets are presented in the next section below.

## Models of forest recreation demand based on the 1990-91 survey results

Similar models to those reported above were estimated using the data obtained in the 1990-91 household surveys. The main difference to the data collected in 1989 was that in the 1990-91 surveys, the dependent variable was a binary variable equal to 1 if the respondent had been to a forest in the last four weeks (as opposed to having been on a trip and been to a forest on the last occasion). Trips were also defined as visits of any duration (rather than having to be over 3 hours long) and all the data sets identified trips that had only been made from home. It was felt that this data would produce better models of participation because it did not require the assumption to be made that the destination of the last trip is an accurate estimate of the probable destination of any randomly selected trip and, by including trips of any duration and separating trips from home and holiday locations, it was expected that the dependent variable would be more closely related to the woodland supply variables.

The results of the models estimated using this data are shown in Tables 4.4.6 and 4.4.8. The models constructed for participation in England and Wales were very similar to those constructed using the 1989 data. Age was slightly less significant than before but showed the same overall effect on participation, men participated significantly more than women, as did car owners, and working status was insignificant in all the models. The presence of children in the household had a similar effect on participation as before, but this was only significant in the 6-9 range. The effect of social class was also similar to before, but the dummy variable for social class A was the second highest (after social class B) and significant, which was much closer to what was expected *a priori* if this were a reflection of the effect of income on participation.

The pattern of seasonal variation could not really be compared with what had occurred before because only three surveys had been carried out in each of the two years. Participation in July 1990 was slightly higher than in April 1990 (but this was not significant) and participation in October 1990 was significantly much lower. Participation in April 1991 was not significantly different to the year before, but participation in July 1991 was significantly lower and October 1991 significantly much lower than had occurred in April 1990. All that could be gleaned from these results was that the seasonal

Table 4.4.6 Results of probit estimation of forest recreation demand functions using results of the household surveys from England and Wales in 1990–91 and incorporating supply variables (percentage forest cover) into the analysis

Dependent variable: Been on a forest visit from home in the last four weeks

| Data source for supply variable | No supply variable | | Census | | Satellite | | Forest rec. database | |
|---|---|---|---|---|---|---|---|---|
| Independent variables | Coefficient | t-statistic | Coefficient | t-statistic | Coefficient | t-statistic | Coefficient | t-statistic |
| Constant | −1.3968 | −12.65 | −1.6606 | −13.47 | −1.5778 | −13.71 | −1.5216 | −13.46 |
| Socio-economic variables | | | | | | | | |
| Age of respondent | 0.0053 | 1.43 | 0.0059 | 1.60 | 0.0063 | 1.70 | 0.0056 | 1.50 |
| $Age^2$ | −0.0001 | −2.83 | −0.0002 | −3.03 | −0.0001 | −3.14 | −0.0001 | −2.93 |
| Socio-economic dummies | | | | | | | | |
| Male | 0.0731 | 2.30 | 0.0729 | 2.29 | 0.0749 | 2.31 | 0.0730 | 2.29 |
| In full-time work | −0.0038 | −0.10 | −0.0018 | −0.05 | −0.0073 | −0.19 | −0.0033 | −0.09 |
| In part-time work | 0.0429 | 0.87 | 0.0423 | 0.86 | 0.0373 | 0.76 | 0.0405 | 0.82 |
| Car owner | 0.4153 | 10.65 | 0.4110 | 10.49 | 0.4082 | 10.42 | 0.4122 | 10.52 |
| Social class A | 0.3651 | 3.23 | 0.3888 | 3.42 | 0.3909 | 3.44 | 0.3874 | 3.41 |
| Social class B | 0.4317 | 8.90 | 0.4304 | 8.88 | 0.4345 | 8.91 | 0.4393 | 9.00 |
| Social class C1 | 0.2742 | 6.53 | 0.2670 | 6.33 | 0.2662 | 6.31 | 0.2379 | 6.50 |
| Social class C2 | 0.1201 | 3.00 | 0.1099 | 2.74 | 0.1098 | 2.73 | 0.1127 | 2.80 |
| Has children under 3 in household | −0.0496 | −1.35 | −0.0472 | −1.28 | −0.0492 | −1.33 | −0.0486 | −1.32 |
| Has children aged 3–5 in household | 0.0364 | 1.00 | 0.0366 | 1.00 | 0.0381 | 1.05 | 0.0368 | 1.01 |
| Has children aged 6–9 in household | 0.0826 | 2.75 | 0.0813 | 2.71 | 0.0823 | 2.74 | 0.0827 | 2.75 |
| Has children aged 10–15 in household | −0.0460 | −1.76 | −0.0474 | −1.82 | −0.0473 | −1.81 | −0.0471 | −1.80 |
| Seasonal dummies | | | | | | | | |
| Jul 90 | 0.0054 | 0.12 | 0.0207 | 0.44 | 0.0191 | 0.41 | 0.0193 | 0.41 |
| Oct 90 | −0.1907 | −3.85 | −0.1737 | −3.50 | −0.1707 | −3.43 | −0.1674 | −3.36 |
| Apr 91 | −0.0417 | −0.91 | −0.0268 | −0.58 | −0.0293 | −0.63 | −0.0152 | −0.33 |
| Jul 91 | −0.1259 | −2.55 | −0.1072 | −2.16 | −0.1084 | −2.19 | −0.1000 | −2.01 |
| Oct 91 | −0.2130 | −4.02 | −0.1935 | −3.63 | −0.2014 | −3.79 | −0.1882 | −3.53 |
| Locational dummies | | | | | | | | |
| Lives in urban constituency | −0.1049 | −3.63 | −0.0294 | −0.85 | −0.0311 | −0.90 | −0.0203 | −0.59 |
| Greater London | NA | NA | −0.0679 | −1.65 | −0.0545 | −1.11 | −0.2410 | −4.74 |
| West Midlands | NA | NA | −0.0399 | −0.37 | −0.0035 | −0.32 | −0.0784 | −0.74 |
| Tyneside | NA | NA | 0.0119 | 0.20 | −0.0208 | −0.36 | −0.0553 | −0.96 |
| Merseyside/Greater Manchester | NA | NA | −0.1733 | −2.27 | −0.1914 | −2.57 | −0.2683 | −3.67 |
| Supply variable | | | | | | | | |
| Percentage woodland cover in county | NA | NA | 2.1327 | 5.05 | 2.3948 | 6.30 | 6.0453 | 5.98 |
| Number of observations | | 12076 | | 12076 | | 12076 | | 12075 |
| Test statistics | | | | | | | | |
| Log-likelihood | | −4872 | | −4849 | | −4842 | | −4844 |
| Restricted log-likelihood | | −5156 | | −5156 | | −5156 | | −5156 |
| Chi-squared | | 568 | | 613 | | 627 | | 623 |
| Aldrich & Nelson's $R^2$ (normalised) | | 0.098 | | 0.105 | | 0.107 | | 0.107 |
| Table of predicted outcomes from | Predicted | | Predicted | | Predicted | | Predicted | |
| the model against actual outcomes | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| Actual 0 | 10213 | 22 | 10187 | 48 | 10175 | 60 | 10200 | 34 |
| 1 | 0 | 1841 | 0 | 1841 | 0 | 1841 | 0 | 1841 |
| Proportion of correct predictions | | 0.998 | | 0.996 | | 0.995 | | 0.997 |
| Goodman & Kruskal's $R^2$ | | 0.988 | | 0.974 | | 0.967 | | 0.982 |

Table 4.4.7 Results of probit estimation of forest recreation demand functions using results of the household surveys from England and Wales in 1990–91 and incorporating supply variables (area of woodland within 50 km and distance-weighted area) into the analysis

Dependent variable: Been on a forest visit from home in the last four weeks

| Data source and supply variable | Woodland area within 50 km of respondents home | | | | Distance-weighted area of woodland | | | |
|---|---|---|---|---|---|---|---|---|
| | Satellite | | Forest rec. database | | Satellite | | Forest rec. database | |
| Independent variables | Coefficient | t-statistic | Coefficient | t-statistic | Coefficient | t-statistic | Coefficient | t-statistic |
| Constant | −1.5375 | −11.78 | −1.5213 | −11.80 | −1.5850 | −11.80 | −1.6561 | −12.45 |
| Socio-economic variables | | | | | | | | |
| Age of respondent | 0.0060 | 1.31 | 0.0060 | 1.30 | 0.0062 | 1.35 | 0.0066 | 1.45 |
| $Age^2$ | −0.0001 | −2.52 | −0.0001 | −2.50 | −0.0001 | −2.55 | −0.0001 | −2.66 |
| Socio-economic dummies | | | | | | | | |
| Male | 0.0816 | 2.54 | 0.0797 | 2.48 | 0.0816 | 2.54 | 0.0815 | 2.54 |
| In full-time work | −0.0086 | −0.22 | −0.0067 | −0.17 | −0.0087 | −0.23 | −0.0127 | −0.33 |
| In part-time work | 0.0457 | 0.92 | 0.0456 | 0.92 | 0.0458 | 0.92 | 0.0465 | 0.94 |
| Car owner | 0.4155 | 10.54 | 0.4161 | 10.55 | 0.4131 | 10.48 | 0.4190 | 10.62 |
| Social class A | 0.3339 | 2.90 | 0.3310 | 2.87 | 0.3352 | 2.91 | 0.3275 | 2.84 |
| Social class B | 0.4183 | 8.53 | 0.4211 | 8.59 | 0.4242 | 8.66 | 0.4180 | 8.51 |
| Social class C1 | 0.2585 | 6.11 | 0.2618 | 6.19 | 0.2629 | 6.22 | 0.2590 | 6.11 |
| Social class C2 | 0.1111 | 2.76 | 0.1132 | 2.81 | 0.1135 | 2.82 | 0.1096 | 2.72 |
| Has children under 3 in household | −0.0473 | −1.28 | −0.0467 | −1.26 | −0.0479 | −1.29 | −0.0479 | −1.29 |
| Has children aged 3–5 in household | 0.0321 | 0.88 | 0.0320 | 0.88 | 0.0327 | 0.90 | 0.0313 | 0.86 |
| Has children aged 6–9 in household | 0.0791 | 2.61 | 0.0792 | 2.61 | 0.0792 | 2.62 | 0.0797 | 2.63 |
| Has children aged 10–15 in household | −0.0428 | −1.63 | −0.0436 | −1.66 | −0.0428 | −1.63 | −0.0419 | −1.59 |
| Seasonal dummies | | | | | | | | |
| Jul 90 | 0.0032 | 0.07 | 0.0005 | 0.01 | 0.0029 | 0.06 | 0.0037 | 0.08 |
| Oct 90 | −0.1946 | −3.89 | −0.1948 | −3.89 | −0.1943 | −3.88 | −0.1870 | −3.73 |
| Apr 91 | −0.0469 | −1.01 | −0.0446 | −0.96 | −0.0418 | −0.90 | −0.0383 | −0.82 |
| Jul 91 | −0.1235 | −2.48 | −0.1188 | −2.39 | −0.1231 | −2.47 | −0.1194 | −2.40 |
| Oct 91 | −0.2071 | −3.88 | −0.2074 | −3.89 | −0.2044 | −3.83 | −0.1942 | −3.63 |
| Locational dummy | | | | | | | | |
| Lives in urban constituency | −0.1177 | −4.01 | −0.1309 | −4.41 | −0.1135 | −3.88 | −0.1349 | −4.56 |
| Supply variable | | | | | | | | |
| Area of woodland around home location | 0.000003 | 4.43 | 0.000011 | 5.06 | 0.0002 | 4.21 | 0.0010 | 6.44 |
| Number of observations | | 11919 | | 11919 | | 11919 | | 11919 |
| Test statistics | | | | | | | | |
| Log-likelihood | | −4795 | | −4792 | | −4796 | | −4784 |
| Restricted log-likelihood | | −5083 | | −5083 | | −5083 | | −5083 |
| Chi-squared | | 577 | | 582 | | 575 | | 599 |
| Aldrich & Nelson's $R^2$ (normalised) | | 0.100 | | 0.101 | | 0.100 | | 0.104 |
| Table of predicted outcomes from | Predicted | | Predicted | | Predicted | | Predicted | |
| the model against actual outcomes | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| Actual 0 | 10082 | 23 | 10071 | 34 | 10082 | 23 | 10088 | 17 |
| 1 | 0 | 1814 | 0 | 1814 | 0 | 1814 | 0 | 1814 |
| Proportion of correct predictions | | 0.998 | | 0.997 | | 0.998 | | 0.999 |
| Goodman & Kruskal's $R^2$ | | 0.987 | | 0.981 | | 0.987 | | 0.991 |

Table 4.4.8 Results of probit estimation of forest recreation demand functions using results of the household surveys from Scotland in 1990–91 and incorporating supply variables (percentage forest cover) into the analysis

Dependent variable: Been on a forest visit from home in the last four weeks

| Data source for supply variable | No supply variable | | Census | | Satellite | | Forest rec. database | |
|---|---|---|---|---|---|---|---|---|
| Independent variables | Coefficient | t-statistic | Coefficient | t-statistic | Coefficient | t-statistic | Coefficient | t-statistic |
| Constant | –0.9890 | –9.12 | –0.8424 | –6.35 | –1.0359 | –8.06 | –0.9352 | –8.26 |
| Age dummies | | | | | | | | |
| Age 18–24 | 0.0167 | 0.15 | 0.0180 | 0.17 | 0.0161 | 0.18 | 0.0162 | 0.15 |
| Age 25–34 | –0.1112 | –1.04 | –0.1062 | –0.99 | –0.1120 | –1.05 | –0.1111 | –1.04 |
| Age 35–44 | –0.0060 | –0.06 | 0.0019 | 0.02 | –0.0074 | –0.07 | –0.0051 | –0.05 |
| Age 45–54 | –0.3086 | –2.88 | –0.3079 | –2.86 | –0.3154 | –2.94 | –0.3135 | –2.92 |
| Age 55–64 | –0.2981 | –2.73 | –0.2920 | –2.67 | –0.3000 | –2.75 | –0.2952 | –2.71 |
| Age over 64 | –0.6002 | –5.46 | –0.5983 | –5.43 | –0.6015 | –5.47 | –0.6020 | –5.48 |
| Socio–economic dummies | | | | | | | | |
| Male | 0.1447 | 3.17 | 0.1432 | 3.14 | 0.1440 | 3.15 | 0.1423 | 3.12 |
| In full–time work | –0.0665 | –1.24 | –0.0699 | –1.30 | –0.0672 | –1.25 | –0.0679 | –1.23 |
| In part–time work | –0.1277 | –1.77 | –0.1292 | –1.79 | –0.1272 | –1.77 | –0.1288 | –1.79 |
| Social class AB | 0.5012 | 8.42 | 0.4961 | 8.33 | 0.5030 | 8.45 | 0.4966 | 8.33 |
| Social class C1 | 0.3003 | 5.36 | 0.2960 | 5.28 | 0.2973 | 5.30 | 0.2962 | 5.28 |
| Social class C2 | 0.1127 | 2.06 | 0.1119 | 2.04 | 0.1126 | 2.05 | 0.1133 | 2.07 |
| Has children under 5 in household | 0.0173 | 0.29 | 0.0159 | 0.27 | 0.0177 | 0.30 | 0.0160 | 0.27 |
| Has children aged 5–9 in household | 0.1596 | 2.62 | 0.1595 | 2.61 | 0.1598 | 2.62 | 0.1604 | 0.63 |
| Has children aged 10–14 in household | 0.0266 | 0.44 | 0.0253 | 0.42 | 0.0277 | 0.46 | 0.0259 | 0.43 |
| Seasonal dummies | | | | | | | | |
| Aug 90 | –0.1537 | –2.25 | –0.1505 | –2.20 | –0.1553 | –2.27 | –0.1569 | –2.29 |
| Oct 90 | –0.3073 | –4.33 | –0.3078 | –4.34 | –0.3074 | –4.33 | –0.3102 | –4.37 |
| Apr 91 | –0.0967 | –1.43 | –0.1039 | –1.53 | –0.1006 | –1.49 | –0.1060 | –1.56 |
| Jul 91 | –0.0113 | –0.17 | –0.0092 | –0.14 | –0.0134 | –0.20 | –0.1513 | –0.23 |
| Oct 91 | –0.1752 | –2.55 | –0.1728 | –2.51 | –0.1775 | –2.58 | –0.1795 | –2.61 |
| Supply variable | | | | | | | | |
| Percentage woodland cover in region | NA | NA | –0.9408 | –1.89 | 0.6771 | 0.71 | –1.7067 | –1.58 |
| Number of observations | | 6177 | | 6176 | | 6176 | | 6176 |
| Test statistics | | | | | | | | |
| Log–likelihood | | –2471 | | –2467 | | –2469 | | –2468 |
| Restricted log–likelihood | | –2612 | | –2610 | | –2610 | | –2610 |
| Chi–squared | | 281 | | 286 | | 282 | | 284 |
| Aldrich & Nelson's $R^2$ (normalised) | | 0.095 | | 0.097 | | 0.095 | | 0.096 |
| Table of predicted outcomes from | Predicted | | Predicted | | Predicted | | Predicted | |
| the model against actual outcomes | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| Actual 0 | 5205 | 45 | 5216 | 34 | 5213 | 37 | 5224 | 26 |
| 1 | 0 | 927 | 0 | 926 | 0 | 926 | 0 | 926 |
| Proportion of correct predictions | | 0.993 | | 0.994 | | 0.994 | | 0.996 |
| Goodman & Kruskal's $R^2$ | | 0.951 | | 0.963 | | 0.960 | | 0.972 |

pattern of participation appeared to be broadly similar in all three years, with a peak early on in the year around April-May, followed by a small decline in the summer months and a large decline by October.

Supply was significant in all the models in which it was included, and it slightly improved the goodness of fit of the models. Again, the supply measures calculated from the forest recreation database were more significant in the models than the measures calculated from the other two data sources (with the exception of the percentage woodland cover variable) and the models using percentage woodland cover were very marginally better than the models using supply aggregated in the other two ways.

The results using the data collected from Scotland were however, quite different to those that had been achieved earlier. The relationship between age and participation in forest visits became generally one of falling participation as age increased. This fall in participation was significant in the three highest age-groups. The effects of sex, working status, and social class were similar to what had been recorded before, and the effect of children in the household was also broadly the same, with the exception of children in the youngest age category which no longer appeared to reduce participation (although the coefficients on this variable were not significant in any of the three years). The seasonal pattern in participation was different from the 1989 results but, as was discussed above, nothing other than the broad conclusion - that participation was generally lower in October than in the summer months - could be drawn from this.

The most interesting difference in results was obtained though, in the coefficients on the woodland supply variables. Whereas before the coefficients on supply were all positive and significant in two of the cases, two of the coefficients on supply in 1990-91 were negative and none of them were significant. Furthermore, the variable that was probably the most accurate of the three (woodland cover estimated in the 1980 Census) had a negative coefficient with a t-statistic that was almost large enough to be significant at the 5% level. It was suspected that because this was the opposite to what economic theory would suggest and because the supply measures were quite crude (Scottish regions are generally very large - much larger than English counties) this was a reflection of measurement error rather than an indication that increased woodland area should be associated with lower levels of forest recreation.

Squared supply variables were again tried in all the models of participation but as before, they were not significant in any of the models, indicating that only a linear relationship could be found between supply and participation over the range of values of woodland supply that were present in the data set.

Extensions to the basic model of recreation demand

The models of forest recreation demand estimated above were all models of participation (ie the decision to visit or not to visit the woodland) containing socio-economic and forest supply variables as explanatory variables in the model. They were all, therefore, very much simplified versions of the household production function model that was outlined at the start of this section. This simplification was necessary because it was not possible to obtain enough data to estimate the full household production function model. However, some extensions to the basic models were considered to try and get better models (in terms of their explanatory power or concordance with economic theory) or models that would be more useful in a policy or forecasting context. The following four issues were examined as part of this process:

1. the effect of substitute sites on participation;
2. the effect of congestion on participation;
3. the substitution of forest visits for other types of visit; and
4. the relationship between the number of visits and the socio-economic and supply variables;

and models addressing each of these issues were constructed (where possible) before choosing a final model to use in the rest of the analysis.

The influence of the presence of substitute sites is a well known problem in recreation demand modelling that has been examined in several studies (eg Burt and Brewer, 1971; Cesario and Knetsch, 1976; and Cicchetti, Fisher and Smith, 1976). It is usually examined in the context of a single site model such as the travel-cost model, where the presence of substitute sites can bias the estimation of the recreation demand curve. The most obvious substitute for one forest site is another forest site, but this was not a problem in these models because the supply variable was an aggregate measure of all forest sites available to each respondent. The presence of other recreational attractions may influence forest recreation participation however, so an attempt was made to estimate the quantity of substitute sites around each location.

The Countryside Information System contained several datasets of designated areas or land-use types that might be considered substitutes to forests (eg National Parks, Areas of Outstanding Natural Beauty, Environmentally Sensitive Areas, beaches, moorland, and heathland). However the locations of these were strongly correlated with the locations of forests. Other data sources listed the locations of historic houses, monuments, parks and gardens that may be considered as substitutes but, as Appendix 2 shows, many of these were also included in the forest recreation database. Apart from the problems of multicollinearity, there also remained the problem of how to quantify and aggregate these into a measure of the supply of substitutes. It was decided therefore, that in view of these problems of aggregation and multicollinearity, it would not be possible to construct useful measures of substitute supply that would be likely to be significant in any of the demand models.

This inability to collect useful data on substitute supply was therefore disappointing. But, in thinking about this, it was considered that the dummy variable for urban parliamentary constituencies could, in a way, be considered as a crude measure of the effect of substitutes (ie urban areas have generally less access to the countryside but more access to formal leisure facilities such as swimming pools, sports centres, concert halls, theatres, and cinemas). The coefficient on this variable was negative in all the models (but only significant in a few of them) suggesting the possibility that it might have captured a substitution effect, but more work would be required before a robust measure of substitute supply could be constructed and tried in any of the models of recreation demand.

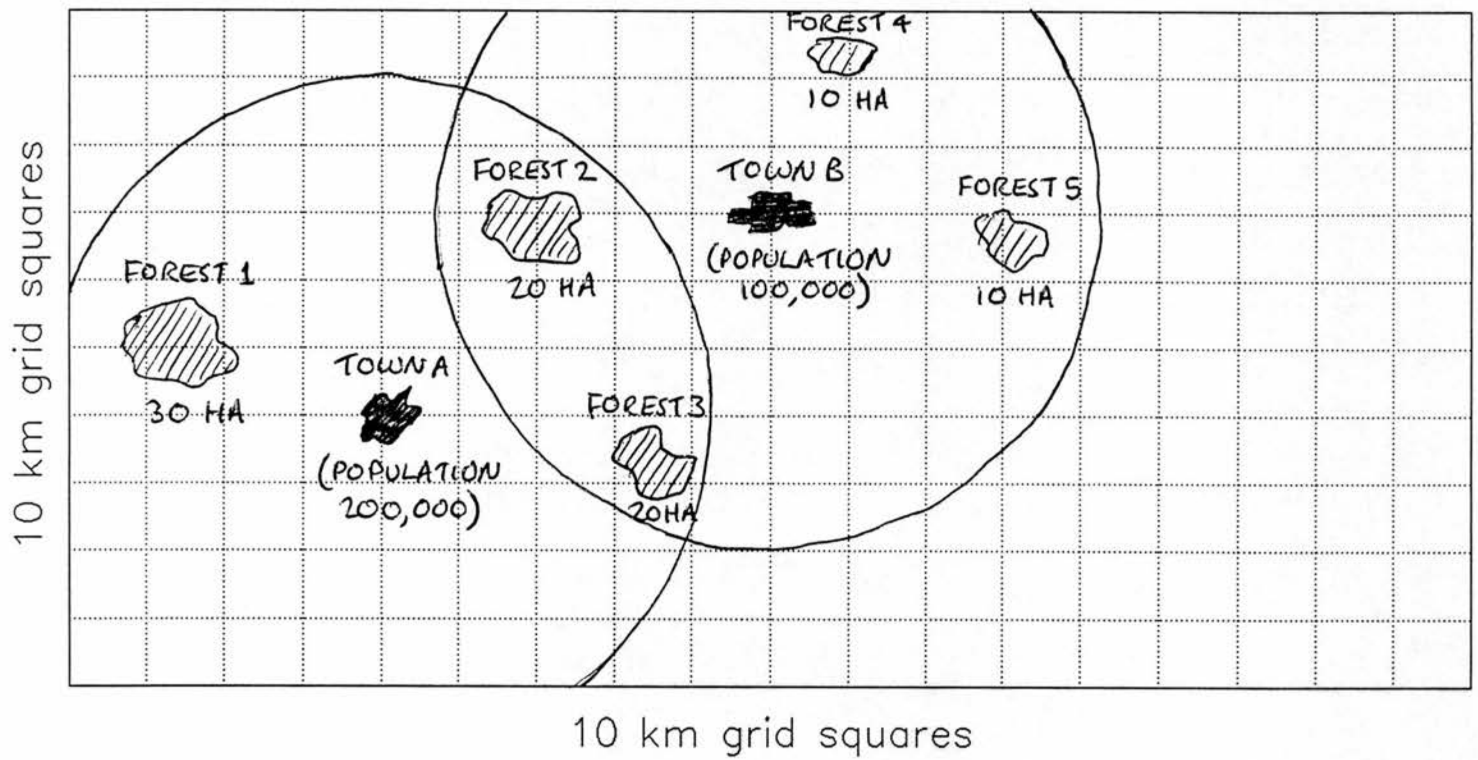
Congestion in woodland, or at recreation sites generally, is a variable that affects the enjoyment of a visit and may therefore, decrease participation. One of the prime motives for taking an outdoor recreation trip is the desire to get away from man-made environments, get close to nature, and generally to "get away from it all". This benefit is often compromised if a site is full of other people. At many locations in the USA, this qualitative aspect of recreation visits is upheld by rationing permits to walk, ride, hunt or fish, which adds a further variable - the probability of being allowed entry or the time to wait for an available permit - to the decision to make a trip to a location, and this has been shown to affect the recreation demand curve (eg McConnel and Duff, 1976). However, in Britain, formal rationing of entry to sites is not common, although the practical difficulties faced by visitors to popular outdoor locations such as parking the car or queuing to use facilities will have a similar effect on enjoyment as rationing through the use of permits.

The main way in which congestion impacts on visitors is on the level of utility they get from a visit. This has been examined with regard to wilderness recreation by Vaux and Williams (1977) and Cicchetti and Smith (1976), and more generally by Price (1979a, 1979b, 1980 and 1981) and Fisher and Krutilla (1972) amongst others. These studies have shown that congestion can affect utility, and that most sites have optimal capacities for recreation visits depending on the characteristics of the sites and their users. If utility is affected by congestion, then the probability of making a visit to a site within the reduced form of the household production function model will also be affected by congestion, and this should be taken into account in any model trying to explain recreational participation. So, for example, two locations, one on the outskirts of London and one in, say, Suffolk might have very similar levels of forest around them but, due to the much greater population pressure and hence likely congestion at sites around London, it would be expected that the probability of making a forest recreation trip would be lower there.

None of the forest supply databases contained any information about site congestion. However, it was possible to construct population pressure variables relating area of woodland to the number of people within the area from the population and forest supply databases. In the case of the models using proportional woodland cover data this was simple and a further variable recording the number of people per hectare of woodland within the county was added to the model. In the case of the other supply variables a slightly more complicated variable was calculated.

The way population pressure was calculated for the other supply variables is best shown with an example. Figure 4.4.9 shows a hypothetical situation of two locations surrounded by five forests. Using the area of woodland less than 50 km away measure, location A has a population of 200,000 and 70 ha of woodland implying a population pressure of 2,860 persons/ha for forests around location A. For location B, the comparable figure is 1,670 persons/ha. This does not however, take into account the fact that forests 2 and 3 count towards the supply measure for both locations. If it is assumed that the

Figure 4.4.9 An example of how the population pressure variable was calculated from data on the location of woodland and population centres



distribution of visitors to each woodland is proportional to its size, then the total population pressure on the forests around location A would be 266,670 (including part of the population of location B visiting forests 2 and 3) implying a population pressure of 3,810 persons/ha, and the population pressure for forests around location B would be 3,570 persons/ha. These figures are both higher than the original figures because they take into account the fact that forests 2 and 3 are visited from both locations (resulting in higher population pressure than if each location was considered in isolation).

This two-stage process of apportioning population to sites on the basis of the proportion of total supply to each location met by each site, then re-aggregating the population going to each site relevant to each location, was used to calculate population pressure figures for all woodlands around each location. This was then divided by woodland supply for each location to give a population pressure variable (in terms of persons/ha) which could be used as a proxy for congestion. In the case of distance-weighted areas the same basic procedure as that outlined above was followed, but the distance weighting function was used in the apportionment and re-aggregation of the population figures. Table 4.4.9 shows the average values of the population pressure variables calculated in this way by county and region in Great Britain. The figures show, not surprisingly, high levels of population pressure in areas of high population and/or low woodland cover. This variable was tried in all of the models and the most significant results are shown in Table 4.4.10.

In the models containing a percentage woodland cover variable, the addition of a population/hectare variable did not improve the models

Table 4.4.9 Comparison of population pressure on woodland calculated from the 1980 Census data (updated to 1990), 1992 satellite data and forest recreation database data

All figures are persons per hectare (or distance-weighted hectare) of woodland

| County | Population per hectare of woodland within county | | | Population per hectare of woodland within 50km | | Population per distance-weighted hectare of woodland | |
|---|---|---|---|---|---|---|---|
| | Census data | Satellite data | Forest rec. database data | Satellite data | Forest rec. database data | Satellite data | Forest rec. database data |
| Avon | 95 | 80 | 523 | 23 | 100 | 20 | 89 |
| Bedfordshire | 62 | 92 | 167 | 68 | 287 | 50 | 206 |
| Berkshire | 29 | 32 | 213 | 46 | 254 | 43 | 173 |
| Buckinghamshire | 22 | 23 | 112 | 60 | 302 | 47 | 189 |
| Cambridgeshire | 74 | 98 | 650 | 45 | 167 | 48 | 179 |
| Cheshire | 82 | 91 | 277 | 74 | 446 | 43 | 217 |
| Cleveland | 122 | 210 | 348 | 35 | 103 | 32 | 95 |
| Cornwall | 20 | 10 | 183 | 11 | 164 | 11 | 94 |
| Cumbria | 7 | 10 | 29 | 11 | 31 | 19 | 59 |
| Derbyshire | 53 | 41 | 150 | 72 | 271 | 56 | 231 |
| Devon | 14 | 12 | 108 | 12 | 105 | 12 | 85 |
| Dorset | 21 | 17 | 114 | 14 | 47 | 21 | 85 |
| Durham | 33 | 49 | 183 | 46 | 175 | 27 | 82 |
| East Sussex | 19 | 20 | 153 | 43 | 208 | 44 | 181 |
| Essex | 81 | 107 | 453 | 89 | 381 | 52 | 220 |
| Gloucestershire | 15 | 17 | 46 | 26 | 111 | 26 | 112 |
| Greater London | 815 | 789 | 893 | 84 | 386 | 52 | 239 |
| Greater Manchester | 709 | 266 | 1650 | 101 | 511 | 55 | 227 |
| Hampshire | 19 | 16 | 35 | 22 | 72 | 32 | 116 |
| Hereford & Worcester | 18 | 18 | 152 | 36 | 183 | 27 | 137 |
| Hertfordshire | 69 | 76 | 302 | 80 | 348 | 52 | 219 |
| Humberside | 69 | 52 | 519 | 43 | 209 | 46 | 176 |
| Isle of Wight | 27 | 22 | 73 | 16 | 47 | 28 | 102 |
| Kent | 28 | 44 | 147 | 58 | 282 | 47 | 195 |
| Lancashire | 92 | 76 | 730 | 82 | 449 | 47 | 179 |
| Leicestershire | 85 | 68 | 400 | 61 | 259 | 50 | 212 |
| Lincolnshire | 24 | 24 | 95 | 40 | 174 | 46 | 188 |
| Merseyside | 637 | 781 | 1163 | 71 | 461 | 39 | 193 |
| Norfolk | 14 | 20 | 89 | 25 | 106 | 33 | 124 |
| North Yorkshire | 8 | 10 | 30 | 44 | 155 | 45 | 160 |
| Northamptonshire | 36 | 25 | 129 | 48 | 212 | 48 | 203 |
| Northumberland | 3 | 5 | 8 | 25 | 62 | 17 | 55 |
| Nottinghamshire | 51 | 54 | 122 | 57 | 213 | 55 | 231 |
| Oxfordshire | 27 | 26 | 159 | 37 | 193 | 39 | 159 |
| Shropshire | 12 | 12 | 90 | 31 | 252 | 28 | 152 |
| Somerset | 19 | 14 | 64 | 16 | 84 | 16 | 80 |
| South Yorkshire | 96 | 162 | 284 | 72 | 280 | 57 | 229 |
| Staffordshire | 47 | 45 | 188 | 74 | 345 | 45 | 221 |
| Suffolk | 17 | 29 | 65 | 34 | 108 | 41 | 157 |
| Surrey | 22 | 23 | 166 | 53 | 288 | 46 | 191 |
| Tyne & Wear | 507 | 823 | 1758 | 50 | 177 | 22 | 70 |
| Warwickshire | 54 | 64 | 183 | 63 | 295 | 44 | 197 |
| West Midlands | 1060 | 662 | 1503 | 68 | 311 | 40 | 198 |
| West Sussex | 16 | 16 | 112 | 41 | 197 | 41 | 162 |
| West Yorkshire | 165 | 142 | 651 | 78 | 373 | 56 | 209 |
| Wiltshire | 17 | 17 | 100 | 19 | 76 | 27 | 109 |
| England | 38 | 40 | 151 | 63 | 290 | 38 | 161 |
| Clwyd | 14 | 9 | 79 | 23 | 204 | 28 | 153 |
| Dyfed | 4 | 3 | 19 | 6 | 38 | 10 | 56 |
| Gwent | 19 | 73 | 78 | 18 | 79 | 16 | 82 |
| Gwynedd | 4 | 4 | 18 | 9 | 50 | 16 | 83 |
| Mid Glamorgan | 26 | 25 | 56 | 14 | 64 | 14 | 73 |
| Powys | 1 | 1 | 11 | 6 | 31 | 15 | 81 |
| South Glamorgan | 119 | 111 | 463 | 17 | 70 | 14 | 76 |
| West Glamorgan | 17 | 18 | 94 | 10 | 58 | 11 | 67 |
| Wales | 9 | 7 | 42 | 13 | 72 | 15 | 81 |
| Borders | 1 | 2 | 16 | 8 | 35 | 12 | 40 |
| Central | 4 | 7 | 7 | 25 | 68 | 11 | 29 |
| Dumfries & Galloway | 1 | 1 | 3 | 2 | 6 | 8 | 24 |
| Fife | 16 | 33 | 113 | 23 | 124 | 11 | 35 |
| Grampian | 2 | 4 | 32 | 4 | 39 | 5 | 28 |
| Highland | 1 | 2 | 5 | 2 | 6 | 3 | 13 |
| Lothian | 34 | 62 | 660 | 24 | 125 | 12 | 35 |
| Strathclyde | 6 | 14 | 31 | 22 | 50 | 10 | 26 |
| Tayside | 3 | 6 | 21 | 11 | 46 | 8 | 29 |
| Scotland | 3 | 6 | 20 | 17 | 54 | 10 | 28 |
| Great Britain | 18 | 23 | 89 | 51 | 227 | 37 | 157 |

Table 4.4.10 Results of probit estimation of forest recreation demand functions using results of the household surveys from England and Wales in 1989 and incorporating supply and population pressure variables into the analysis

Dependent variable: Been on a countryside outing in the last two months and visited a forest from home on the last occasion

| Data source and supply variable | Woodland area within 50 km of respondents home | | | | Distance-weighted area of woodland | | | |
|---|---|---|---|---|---|---|---|---|
| | Satellite | | Forest rec. database | | Satellite | | Forest rec. database | |
| Independent variables | Coefficient | t-statistic | Coefficient | t-statistic | Coefficient | t-statistic | Coefficient | t-statistic |
| Constant | −2.0092 | −13.74 | −1.9825 | −13.97 | −2.1057 | −13.15 | −1.9772 | −13.31 |
| Socio-economic variables | | | | | | | | |
| Age of respondent | 0.0125 | 2.14 | 0.0123 | 2.10 | 0.0127 | 2.17 | 0.0127 | −2.17 |
| $Age^2$ | −0.0002 | −2.95 | −0.0002 | −2.89 | −0.0002 | −2.95 | −0.0002 | −2.96 |
| Socio-economic dummies | | | | | | | | |
| Male | 0.0948 | 2.21 | 0.0908 | 2.12 | 0.0948 | 2.20 | 0.0914 | 2.13 |
| In full-time work | 0.0218 | 0.44 | 0.0234 | 0.47 | 0.0229 | 0.46 | 0.0253 | 0.51 |
| In part-time work | −0.0306 | −0.48 | −0.0323 | −0.50 | −0.0262 | −0.39 | −0.0299 | −0.46 |
| Car owner | 0.2654 | 5.04 | 0.2670 | 5.07 | 0.2380 | 5.01 | 0.2673 | 5.08 |
| Social class A | 0.0298 | 0.18 | 0.0214 | 0.13 | 0.0311 | 0.19 | 0.0286 | 0.17 |
| Social class B | 0.2216 | 3.33 | 0.2173 | 3.27 | 0.2247 | 3.38 | 0.2179 | 3.28 |
| Social class C1 | 0.2131 | 3.77 | 0.2089 | 3.69 | 0.2208 | 3.90 | 0.2106 | 3.72 |
| Social class C2 | 0.1193 | 2.20 | 0.1146 | 2.11 | 0.1209 | 2.22 | 0.1094 | 2.01 |
| Has children under 3 in household | −0.0160 | −0.35 | −0.0172 | −0.37 | −0.0168 | −0.37 | −0.0229 | −0.50 |
| Has children aged 3–5 in household | 0.0553 | 1.41 | 0.0553 | 1.40 | 0.0546 | 1.39 | 0.0555 | 1.41 |
| Has children aged 6–9 in household | 0.0901 | 2.56 | 0.0901 | 2.56 | 0.0922 | 2.62 | 0.0901 | 2.56 |
| Has children aged 10–15 in household | 0.0731 | 2.59 | 0.0723 | 2.56 | 0.0731 | 2.59 | 0.0709 | 2.51 |
| Seasonal dummies | | | | | | | | |
| May–Jun 89 | −0.1045 | −1.83 | −0.1130 | −1.98 | −0.0986 | −1.73 | −0.0980 | −1.72 |
| Jun–Jul 89 | −0.1383 | −2.34 | −0.1451 | −2.45 | −0.1332 | −2.25 | −0.1344 | −2.27 |
| Jul–Aug 89 | −0.1466 | −2.58 | −0.1501 | −2.64 | −0.1405 | −2.47 | −0.1398 | −2.46 |
| Sep–Oct 89 | −0.2030 | −3.27 | −0.2084 | −3.35 | −0.1983 | −3.19 | −0.1942 | −3.12 |
| Locational dummy | | | | | | | | |
| Lives in urban constituency | −0.0675 | −1.69 | −0.0798 | −1.99 | −0.0627 | −1.63 | −0.0628 | −1.63 |
| Supply variable | | | | | | | | |
| Area of woodland around home location | 0.000004 | 5.14 | 0.000014 | 5.48 | 0.0003 | 5.44 | 0.0009 | 6.02 |
| Population pressure variable | | | | | | | | |
| Population per hectare of woodland | −0.0009 | −1.23 | −0.0001 | −0.7 | −0.0015 | −1.05 | −0.0007 | −2.14 |
| Number of observations | | 10432 | | 10432 | | 10432 | | 10432 |
| Test statistics | | | | | | | | |
| Log-likelihood | | −2604 | | −2603 | | −2603 | | −2601 |
| Restricted log-likelihood | | −2733 | | −2733 | | −2733 | | −2733 |
| Chi-squared | | 257 | | 259 | | 259 | | 264 |
| Aldrich & Nelson's $R^2$ (normalised) | | 0.070 | | 0.071 | | 0.071 | | 0.072 |
| Table of predicted outcomes from | Predicted | | Predicted | | Predicted | | Predicted | |
| the model against actual outcomes | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| Actual 0 | 9668 | 0 | 9668 | 0 | 9668 | 0 | 9668 | 0 |
| 1 | 0 | 764 | 0 | 764 | 0 | 764 | 0 | 764 |
| Proportion of correct predictions | | 1.000 | | 1.000 | | 1.000 | | 1.000 |
| Goodman & Kruskal's $R^2$ | | 1.000 | | 1.000 | | 1.000 | | 1.000 |

because the two variables were highly correlated. This resulted in a significant negative coefficient on the population pressure variable and an insignificant coefficient on the supply variable in the models for Scotland. The models for England and Wales were slightly better in that the addition of this variable did not significantly affect the values of the other coefficients. However, the coefficient on population pressure was still very small and insignificant in all cases (similar results were obtained from the 1990/91 data to those from 1989). In the models constructed using the other supply measures the results were more promising, and recorded a much more significant negative coefficient on the population pressure variable. While this was only significant at the 5% level in one of the models, the t-statistic on this variable was quite high in all cases and had the expected (negative) sign indicating that a higher degree of population pressure might lead to reductions in participation.

In the models of participation in 1989, the dependent variable was a 1 or 0 depending on whether respondents had been on a countryside/leisure outing and been to a forest on the last occasion. As was discussed in Chapter 2, this could have been modelled as two separate participation functions, the first relating participation in countryside/leisure outings to socio-economic variables and the second relating forest visits (given that an outing had taken place) to socio-economic and supply variables. It was decided to model the two decisions jointly to make the results from 1989 more comparable to the results obtained in 1990-91. However, it was later decided to investigate the factors influencing the second decision separately to see if this could indicate the proportion of any change in visits to woodland arising from a change in supply that could be considered new visits and the proportion that would be visits drawn from other sites.

The net effect on recreation numbers of an increase in the provision of woodland is:

- the change in forest visitor numbers brought about by the provision of new woodland; minus
- any recreation displaced from the area where the woodland is planted; and
- any substitution of woodland visits for other types of recreation that would have taken place elsewhere in the absence of the new woodland being planted.

The models developed as part of this work gave estimates of the effect of changes in supply on gross visitor numbers (ie the first item above) but did not take into account the other two factors.

The common assumption in many studies of forest recreation is that the second effect is minimal. This is questionable where afforestation takes place on already well used sites (as was pointed out in the discussion of the effect of early afforestation in the Lake District in Chapter 2) but may be a reasonable assumption in the current policy environment where forestry expansion is now being directed towards agricultural land (which in most cases will not have been used for recreation before).

Examination of the third factor is very interesting because it allows any forecast change in gross visitor numbers resulting from a change in forest area to be split into new visitors and visitors changing from another type of site to forests. The benefits attributable to such visits while still being positive (or they would not occur) are likely to be different to the benefits obtained by new visitors so this is a useful differentiation to make when appraising the effect of woodland expansion.

The way this was examined was that it was assumed that all respondents in the survey faced an equal amount of alternative recreation options (see the above discussion on substitution), so that modelling the effect of supply on forest visits given that respondents had already decided to go out would give an indication of this substitution effect. Models were therefore, constructed using the smaller sample in 1989 of visitors that had been on a countryside/leisure outing with the dependent variable equal to 1 if the respondents had been to a forest given that an outing had taken place, and the results of some of these models are shown in Table 4.4.11.

The proportion of visitors that had decided to go on a forest visit (having already chosen to go out) was higher than the proportion of all respondents that had decided to go out and go on a forest visit because of the smaller sample size. Few of the socio-economic variables were significant in these models because the results only registered significant differences between the effect of these variables on forest recreation participation and general countryside/leisure participation. The supply variable was significant in all the models though, and the effect of supply on participation in one of the models is compared to the effect of supply on the comparable earlier model in Figure 4.4.10.

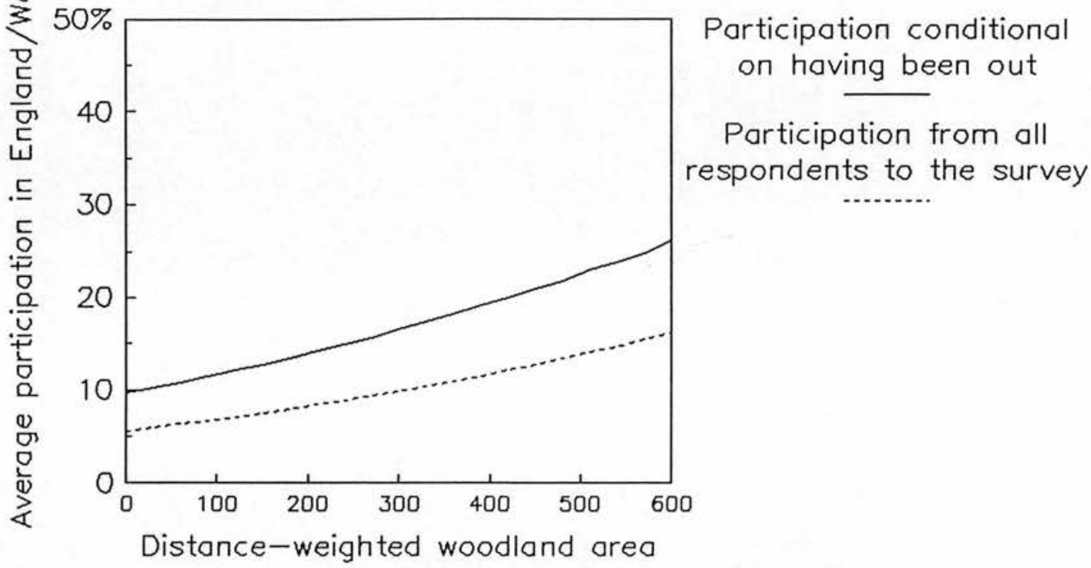
From these results, it was possible to take the first derivative of each of the functions relating participation to forest supply and, holding the proportion of respondents making countryside/leisure

Table 4.4.11 Results of probit estimation of forest recreation demand functions using results of the household surveys in England and Wales in 1989 and showing the effect of recreational woodland area on the probability of making a forest visit given that a countryside outing has been made

Dependent variable: Been forest outing from home given that a countryside outing has been made in the last two months

| Data source and supply variable | Forest recreation database | | | | | |
|---|---|---|---|---|---|---|
| | Proportion woodland cover | | Woodland area within 50km | | Distance-weighted wood area | |
| Independent variables | Coefficient | t-statistic | Coefficient | t-statistic | Coefficient | t-statistic |
| Constant | -1.2281 | -7.79 | -1.2354 | -7.79 | -1.3600 | -8.37 |
| Socio-economic variables | | | | | | |
| Age of respondent | 0.0047 | 0.67 | 0.0057 | 0.82 | 0.0063 | 0.90 |
| $Age^2$ | -0.0001 | -1.40 | -0.0001 | -1.52 | -0.0001 | -1.60 |
| Socio-economic dummies | | | | | | |
| Male | 0.0724 | 1.45 | 0.0747 | 1.50 | 0.0752 | 1.51 |
| In full-time work | 0.0211 | 0.36 | 0.0166 | 0.29 | 0.0124 | 0.21 |
| In part-time work | -0.0773 | -1.05 | -0.0751 | -1.02 | -0.0769 | -1.05 |
| Car owner | 0.1051 | 1.65 | 0.1092 | 1.72 | 0.1101 | 1.74 |
| Social class A | -0.1667 | -0.91 | -0.1902 | -1.04 | -0.1966 | -1.08 |
| Social class B | 0.0631 | 0.82 | 0.0423 | 0.55 | 0.0381 | 0.50 |
| Social class C1 | 0.0642 | 0.97 | 0.0571 | 0.87 | 0.0519 | 0.79 |
| Social class C2 | 0.0517 | 0.80 | 0.0487 | 0.75 | 0.0358 | 0.55 |
| Has children under 3 in household | -0.0064 | -0.12 | 0.0407 | 0.01 | -0.0060 | -0.11 |
| Has children aged 3-5 in household | 0.0438 | 0.95 | 0.0417 | 0.91 | 0.0426 | 0.93 |
| Has children aged 6-9 in household | 0.1021 | 2.41 | 0.1037 | 2.45 | 0.1070 | 2.52 |
| Has children aged 10-15 in household | 0.1059 | 3.09 | 0.1140 | 3.32 | 0.1134 | 3.31 |
| Seasonal dummies | | | | | | |
| May-Jun 89 | -0.1378 | -2.05 | -0.1659 | -2.48 | -0.1439 | -2.24 |
| Jun-Jul 89 | -0.2035 | -2.92 | -0.2148 | -3.12 | -0.2090 | -3.03 |
| Jul-Aug 89 | -0.2494 | -3.77 | -0.2802 | -4.28 | -0.2676 | -4.08 |
| Sep-Oct 89 | -0.1932 | -2.62 | -0.2029 | -2.77 | -0.1913 | -2.61 |
| Locational dummies | | | | | | |
| Lives in urban constituency | -0.0129 | -0.25 | -0.0530 | -1.20 | -0.0345 | -0.78 |
| Greater London | -0.2141 | -2.38 | NA | NA | NA | NA |
| West Midlands | -0.0720 | -0.65 | NA | NA | NA | NA |
| Tyneside | 0.1806 | 1.40 | NA | NA | NA | NA |
| Merseyside/Greater Manchester | 0.1307 | 1.53 | NA | NA | NA | NA |
| Supply variable | | | | | | |
| Area/proportion of woodland | 8.2917 | 7.28 | 0.000015 | 5.59 | 0.0011 | 6.43 |
| Number of observations | | 5094 | | 5094 | | 5094 |
| Test statistics | | | | | | |
| Log-likelihood | | -2076 | | -2088 | | -2083 |
| Restricted log-likelihood | | -2153 | | -2153 | | -2153 |
| Chi-squared | | 155 | | 131 | | 140 |
| Aldrich & Nelson's $R^2$ (normalised) | | 0.064 | | 0.054 | | 0.058 |
| Table of predicted outcomes from | Predicted | | Predicted | | Predicted | |
| the model against actual outcomes | 0 | 1 | 0 | 1 | 0 | 1 |
| Actual 0 | 4316 | 14 | 4322 | 8 | 4309 | 21 |
| 1 | 0 | 764 | 0 | 764 | 0 | 764 |
| Proportion of correct predictions | | 0.997 | | 0.998 | | 0.996 |
| Goodman & Kruskal's $R^2$ | | 0.982 | | 0.990 | | 0.973 |

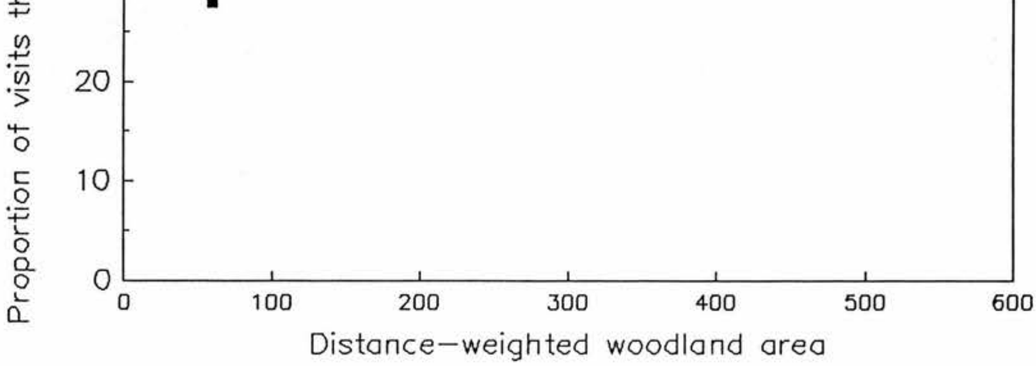
Figure 4.4.10 A comparison between participation in forest visits of all respondents and those that had been on a countryside outing in 1989




Note: Other variables in the model are set so as to represent a male, car owner, social class B, with no children, average age, in an urban area

Participation is defined as having been on a visit lasting more than three hours total duration in the last two months

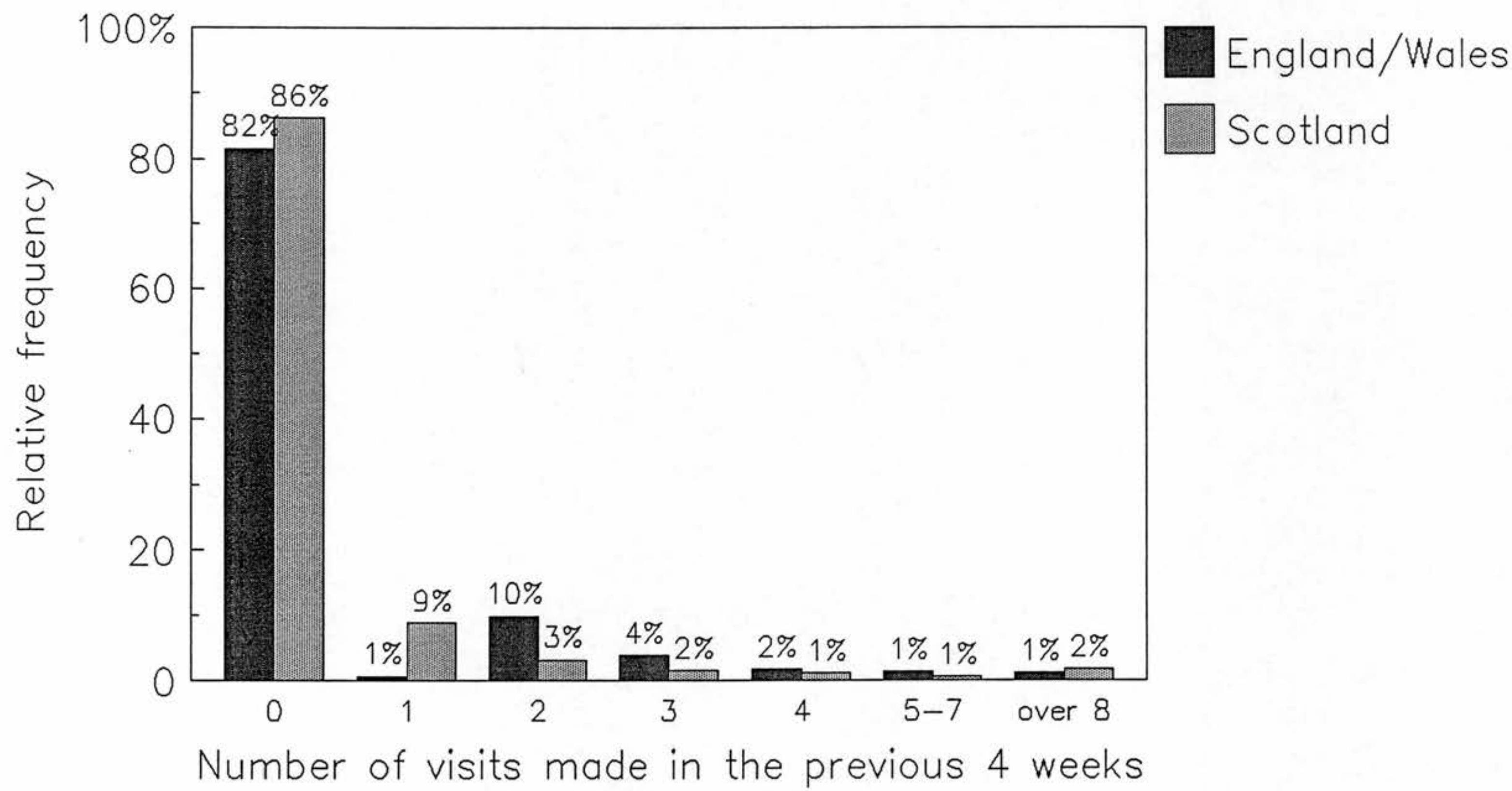
Figure 4.4.11 The proportion of the change in visitor numbers as a result of a change in forest area that are new visits



outings constant, show the proportion of additional visitors generated by an increase in forest supply (from the earlier models) that would be new visitors at different levels of supply. This was done by subtracting the change in participation registered in the latter model (with overall participation in countryside/leisure trips held constant) from the change in participation registered in the earlier model. By doing this, the models showed that as supply increased, the total number of forest visitors predicted in the earlier model increased by more than the increase in visitors from the latter model (with countryside/leisure participation held constant), the difference being new forest visitors as opposed to visitors changing to forest recreation from other types of recreation. As a proportion of the total increase in visitors, this difference (new visitors) accounted for 30% of the increase at low levels of forest cover and a higher proportion of the increase at higher levels of forest cover (see Figure 4.4.11), implying that more than half of all visitors to a new forest site would be visitors substituting forest recreation for other types of recreation.

The data collected in 1989 only contained a binary dependent variable recording whether the respondent had made a forest visit or not during the recall period. The data collected in 1990-91 however, also recorded the number of forest visits made by the respondent during the recall period. The distribution of the number of forest visits made by respondents in England/Wales and Scotland is shown in Figure 4.4.12. It is possible to get from the level of participation to the number of forest visits made by multiplying the former by the average number of forest visits made, and this was the approach used earlier in this chapter. However, when it came to modelling forest recreation demand

Figure 4.4.12 The distribution of the number of forest visits made (per person) recorded in the 1990-91 forest visitor surveys



it was felt that the relationship between the number of visits made and socio-economic and supply variables should be examined further. Two types of regression models were considered for this purpose: the Poisson regression model; and the standard OLS regression model.

The Poisson model is suggested as an improvement to the OLS model where the dependent variable contains a large number of zeroes and is a discrete variable (for a good example of the use of the Poisson model see McCullagh and Nelson, 1983). For it to work though, the model stipulates that each y variable is drawn from a Poisson distribution. The model can then be estimated using maximum - likelihood techniques to give a series of fitted y values which can be transformed back into discrete values using the Poisson distribution. A problem occurs however, when the data contains too many or too few zeroes to fit the Poisson distribution (referred to as overdispersion or underdispersion, with overdispersion being the problem most frequently encountered). This invalidates the condition implicit in the Poisson distribution that the mean and variance of the distribution of y values are equal, and leads to a larger variance of the estimator than anticipated in the OLS model, and possible losses in efficiency (Winkelmann and Zimmerman, 1993). A poisson model was estimated therefore, and the test for over/ under dispersion suggested by Cameron and Trivedi (1990) was used to appraise the models results. The test indicated that the data set was over dispersed, ruling out the poisson model as a viable model of the frequency of visits made by respondents.

The frequency of visits made therefore was regressed on the same set of independent variables as used before, using OLS regression. Using the complete data set from 1990/91, the results gave predictions mostly in the 0-1 range, so OLS regression models were also constructed for the frequency of forest visits made with the zeroes removed from the data set (see Table 4.4.12). The results indicated that none of the variables had a significant effect on the frequency of visits made, possibly because frequency of participation was related to a different set of factors which the surveys did not examine. This line of enquiry was therefore, taken no further.

Appraisal and use of the forest recreation demand models

Earlier parts of this section have shown how models of forest recreation participation were constructed from the results of the household surveys in 1989 and 1990-91. These were constructed to examine the effect of socio-economic and forest supply variables on forest recreation participation, and can be used in the following ways:

- to crosscheck on the aggregate forest visitor number estimates presented earlier in this chapter;
- to produce forecasts of future forest visitor numbers; and
- to examine the effect on forest visitor numbers of changes in the area and location of woodland.

The models all exhibited strong relationships between several of the socio-economic variables and participation, and the most significant variables affecting participation were age, social class and car ownership (these findings concur with results found in other recreation demand studies). The presence of children within certain age ranges also appeared to influence participation in some cases. The most disappointing feature of the models was the lack of an income variable

Table 4.4.12 Results of an OLS regression model explaining the number of forest visits made in England and Wales in 1990–91 as a function of woodland supply and sociao–economic variables

Dependent variable: Number of visits made in the last 4 weeks given that at least one visit has been made

| Data source and supply variable | Woodland area within 50 km of respondents home | | | | Distance–weighted area of woodland | | | |
|---|---|---|---|---|---|---|---|---|
| | Satellite | | Forest rec. database | | Satellite | | Forest rec. database | |
| Independent variables | Coefficient | t–statistic | Coefficient | t–statistic | Coefficient | t–statistic | Coefficient | t–statistic |
| Constant | 2.7983 | 9.36 | 2.7757 | 9.74 | 2.7777 | 9.26 | 2.6651 | 9.10 |
| Socio–economic variables | | | | | | | | |
| Age of respondent | 0.0010 | 0.10 | 0.0013 | 0.13 | 0.0011 | 0.11 | 0.0019 | 0.19 |
| Age² | –0.000003 | –0.30 | –0.000007 | –0.06 | –0.000004 | –0.04 | –0.000014 | –0.13 |
| Socio–economic dummies | | | | | | | | |
| Male | 0.1374 | 1.71 | 0.1370 | 1.70 | 0.1378 | 1.71 | 0.1391 | 1.72 |
| In full–time work | –0.0750 | –0.78 | –0.0769 | –0.80 | –0.0754 | –0.78 | –0.0829 | –0.86 |
| In part–time work | –0.1420 | –1.15 | –0.1437 | –1.16 | –0.1417 | –1.14 | –0.1461 | –1.18 |
| Car owner | 0.0439 | 0.42 | 0.0428 | 0.40 | 0.0427 | 0.40 | 0.0449 | 0.42 |
| Social class A | 0.2631 | 1.04 | 0.2595 | 1.02 | 0.2642 | 1.04 | 0.2593 | 1.02 |
| Social class B | 0.0365 | 0.31 | 0.0377 | 0.32 | 0.0382 | 0.32 | 0.0345 | 0.29 |
| Social class C1 | 0.0862 | 0.79 | 0.0886 | 0.81 | 0.0878 | 0.81 | 0.0912 | 0.84 |
| Social class C2 | 0.1755 | 1.61 | 0.1773 | 1.62 | 0.1760 | 1.61 | 0.1775 | 1.63 |
| Has children under 3 in household | 0.0847 | 0.91 | 0.0848 | 0.91 | 0.0836 | 0.89 | 0.0813 | 0.87 |
| Has children aged 3–5 in household | –0.0054 | –0.06 | –0.0072 | –0.08 | –0.0075 | –0.07 | –0.0088 | –0.10 |
| Has children aged 6–9 in household | 0.0407 | 0.57 | 0.0400 | 0.56 | 0.0406 | 0.66 | 0.0419 | 0.58 |
| Has children aged 10–15 in household | –0.0372 | –0.57 | –0.0366 | –0.56 | –0.0368 | –0.56 | –0.0369 | –0.55 |
| Seasonal dummies | | | | | | | | |
| Jul 90 | –0.0151 | –0.13 | –0.0156 | –0.14 | –0.0147 | –0.13 | –0.0075 | –0.07 |
| Oct 90 | 0.0229 | 0.18 | 0.0257 | 0.20 | 0.0239 | 0.19 | 0.0399 | 0.32 |
| Apr 91 | –0.0194 | –0.17 | –0.0185 | –0.16 | –0.0173 | –0.14 | –0.0051 | –0.04 |
| Jul 91 | –0.1984 | –1.62 | –0.1947 | –1.59 | –0.1983 | –1.61 | –0.1881 | –1.53 |
| Oct 91 | –0.1416 | –1.00 | –0.1398 | –0.99 | –0.1410 | –0.98 | –0.1225 | –0.87 |
| Locational dummy | | | | | | | | |
| Lives in urban constituency | –0.1434 | –1.86 | –0.1514 | –2.05 | –0.1424 | –1.96 | –0.1565 | –2.14 |
| Supply variable | | | | | | | | |
| Area of woodland around home location | 0.000001 | 0.49 | 0.000005 | 0.94 | 0.000057 | 0.62 | 0.000641 | 1.81 |
| Number of observations | | 2239 | | 2239 | | 2239 | | 2239 |
| Test statistics | | | | | | | | |
| $R^2$ | | 0.008 | | 0.0098 | | 0.009 | | 0.010 |

because income data was not collected in the household surveys. This is an important omission which limits their usefulness for forecasting because income is probably an influential variable affecting participation, which is also likely to change in the future.

A wide range of supply variables were tried in each of the models and most of these had a significant effect in the expected direction (ie that a greater amount of forest is associated with higher forest recreation participation). The results using the data from Scotland were most disappointing in this respect. This, it was suspected, was due to the fact that the location where respondents lived could not be identified to a level of accuracy greater than the local authority region, and that consequently only very crude measures of forest supply could be used in the analysis. One measure of the validity of models is the degree of concordance between the results obtained using different data sets and in this respect the models performed quite well, showing similarity between the two survey periods (1989 and 1990-91 and regions (England/Wales and Scotland).

The models were all significant overall (measured by the chi-squared statistic) but exhibited a low level of goodness-of-fit (as measured by Pseudo-$R^2$ statistics). In view of the fact that this was cross-sectional and limited-dependent variable data however, this should not be seen as strong grounds for criticising the validity and usefulness of the results. The table of actual and predicted 1/0 results showed that there was a high degree of correlation between 1s in the data and high fitted y values (although the unevenness of the independent variable meant that the usual probability hurdle of 0.5 had to be slightly lowered to register this effect), suggesting that the estimated coefficients were unbiased.

It was eventually decided to use the probit model including the distance-weighted area of recreational woodland in England and Wales, and the probit model without a supply variable in Scotland, to perform the three functions listed above. In the case of the latter this was because it was felt that the supply measure did not give robust results and was not accurately measured; this also meant that the effect of changes in forest area on Scottish forest visitor numbers could not be determined.

The choice of distance-weighted area of recreational woodland as the supply variable to use in subsequent analysis was made on the grounds that recreational woodland was the most appropriate variable to use in the model (it was also generally the most significant of the three data sources in all the models examined), and the distance-weighted measure was chosen because it took into account both the location and area of woodland in a way that could be justified more strongly than the other two measures. Although a refinement to the model showed that population pressure may also have a significant effect on participation, it was felt that the complexity of calculating this (especially in any predictive model) would not be outweighed by any gains in accuracy.

The models constructed from the 1989 and 1990-91 data were then used to produce estimates of visitor numbers taking into account:

- the relevant socio-economic characteristics of the British population as a whole;
- the supply of woodlands around each parliamentary constituency (in England/ Wales); and

- scaling factors to get from electoral role to total adult population, weight the monthly results (in the same way as before) and take into account the average number of visits made by those participating.

The results for 1989 and 1990-91 are shown in Table 4.4.13 along with projections to 2031. Because the two survey periods gave such different results, projections based on both are shown, and two projections based on each data set were also made. The lower projection was based on forecast changes in the size, sex and age-structure of the British population only (Central Statistical Office, 1991). This shows forest recreation increasing slightly in England/Wales due to a projected increase in population, but this increase is less than the increase in population due to the ageing of the population. In Scotland this effect combines with a projected fall in population to generate a forecast of falling forest visitor numbers over time. The higher projection was a more speculative projection made for illustrative purposes. It included Department of Transport projections of future car ownership and an assumption that, (in the absence of an income variable) social class reflects income and that 5% of each social class stratum will move up one class in every 10 year period, in addition to the population change data. This forecast shows forest visitor numbers as increasing modestly over the next 40 years.

The most powerful output of these models however, was the construction of a predictive model showing the effect of changes in the location and area of woodland on total forest visitor numbers. This was used to examine a range of forestry expansion options which will be discussed in the next two chapters. It was also used to present the Forestry

Table 4.4.13 Comparison of forest visitor numbers estimated for 1989 and 1900–91 in Section 4.2 with predictions of the forest visit participation models constructed with the same data, and projections from the models to 2031

All figures in millions

| Country and data source | High/low projection | Result in Section 4.2 | Model result | Projection 2001 | 2011 | 2021 | 2031 |
|---|---|---|---|---|---|---|---|
| 1989 survey data | | | | | | | |
| England/Wales | High | 220 | 211 | 208 | 224 | 236 | 246 |
| | Low | | | 201 | 207 | 210 | 211 |
| Scotland | High | 12 | 12 | 12 | 11 | 11 | 10 |
| | Low | | | 12 | 11 | 10 | 10 |
| Great Britain | High | 232 | 223 | 220 | 235 | 247 | 256 |
| | Low | | | 213 | 218 | 220 | 221 |
| 1990–91 survey data | | | | | | | |
| England/Wales | High | 260 | 345 | 362 | 385 | 405 | 420 |
| | Low | | | 352 | 363 | 372 | 374 |
| Scotland | High | 22 | 22 | 22 | 21 | 20 | 19 |
| | Low | | | 21 | 21 | 20 | 18 |
| Great Britain | High | 282 | 367 | 384 | 406 | 425 | 439 |
| | Low | | | 373 | 384 | 392 | 392 |

Note: Figures for 1990/91 are the average of the two years calculated using the second set of weights

Commission with a predictive model to use in appraisals which would show the likely numbers of visitors to newly planted forests or forests opened for recreation. This is discussed further in the next chapter (on community forestry) and final chapter (on directions for future forestry policy).

## Conclusion

The main results of the modelling exercise have already been discussed in some detail so need only be briefly summarised here. This section showed that robust models of forest recreation participation could be constructed using socio-economic and forest supply variable as explanatory variables within a reduced form of the household production function model. From these models, a predictive model of forest recreation was constructed and used to forecast the underlying trend in demand for forest recreation and as a cross-check on the visitor numbers estimated earlier in this chapter. The cross-check suggested that the earlier estimate of forest visitor numbers was reasonably accurate, and that future levels of forest visitor numbers are likely to be only slightly higher than at present given predicted changes in the population and age-structure of population in Britain and a constant forest area. The model can be used to predict the impact of changes in supply on visitor numbers, and this will be examined in the next two sections of this work.

CHAPTER 5

COMMUNITY FORESTS

## 5.1 COLLECTION OF DATA IN COMMUNITY FORESTS

Chapter 2 outlined the scope and objectives of the twelve Community Forests that are currently being developed in England. Because this is a new initiative (there are currently no forests with the same characteristics and on the scale planned for the Community Forests in Britain), it was necessary to collect data on their potential use and value to estimate the benefits that such forests might provide. Surveys were used to do this, and the last of these also attempted to collect qualitative information about preferences for different levels of forest cover to guide decisions about the scale of forests that should be aimed for.

This section discusses how data on predicted use and value and qualitative information about the proposed forests was collected. It starts with a discussion of the survey of residents in the three lead Community Forests. The purpose of these surveys was to collect information about the likely use of the forests for recreation and an estimate of their value. A contingent valuation approach was used to carry out the latter task. It then discusses a further survey undertaken in Greater Manchester to collect qualitative information on the proposed Community Forest there and examine preferences for different amounts of forest cover. This study piloted the use of photographs to explore landscape preferences and the mechanics of using this technique are also discussed at the end of this section.

Sample selection and data collection in the three Lead Community Forests

Three of the Community Forests in the Community Forest Initiative - Forest of Mercia (Walsall), Thames Chase (East London), and Great North Forest (South Tyneside) - were announced and work started on their planning and development before the other nine forests in the Initiative. These three "lead forests" were chosen therefore, as sites for a survey of the potential use of the forests and a contingent valuation survey of the value residents placed on their development.

The survey was structured in two parts. Firstly, 1,000 randomly selected residents were sent a pre-interview briefing describing the proposed Community Forest in each of the three lead areas. Then a market research company was employed to carry out a small household survey in each of the three areas, using a carefully designed questionnaire asking about existing use of the area, likely use of the forest, and willingness to pay for the forest.

Community Forests are primarily aimed at meeting local needs, so the sampling frame or catchment area for each forest was set to include all adults (aged 17 and over) living within a reasonably close distance to the community forest boundary. The boundary of the sampling frame was initially set as the area within 5 miles of the Community Forest boundary. This was modified slightly in consultation with each of the project directors to take into account the effect of good roads and public transport routes and physical barriers to accessibility such as rivers. Once the boundary of the sampling frame was agreed, postcode sector maps were then used to determine the postcode sectors that made up the area. Table 5.1.1 shows the number of postcode sectors selected within each area.

The aim of the sampling strategy was to obtain an efficient and unbiased sample of individuals that would be representative of the sampling frame at minimum cost. It was decided that this would be best achieved by selecting a limited number of postcode sectors at random from which a further random selection of individuals would be taken. To avoid the need for repeat visits, 1,000 individuals were selected within each of the community forest sampling frames, with the intention of obtaining 300 responses. This two-stage cluster design was chosen because it combined a reasonably small design effect with a low overall cost of surveying. Figures 5.1.1 to 5.1.3 show the postcode sectors selected in relation to the Community Forest boundaries.

All the 1,000 individuals selected were then sent a letter from the local project director and an information leaflet on 22 January 1992 (see Appendix 3). The letter notified them about the forthcoming survey and encouraged recipients to read the leaflet. The leaflet contained pictures showing what the community forest might look like, and some text discussing what the forest will provide. It also contained a map showing the community forest boundary, so that respondents could assess how close the community forest would be to them and how large an area would be affected. Of the 3,000 leaflets sent, 73 were returned by the Post Office and did not reach individuals in the sample for a variety of reasons.

The pictures and wording of the leaflet were carefully chosen so as not to give an unrealistically good impression of what the forests would

| Table 5.1.1 Number of postcode sectors selected for the recreation survey in the three lead Community Forests | | | |
|---|---|---|---|
| | Forest of Mercia | Thames Chase | Great North Forest |
| Total number of sectors within the catchment area | 151 | 113 | 117 |
| Number of sectors selected | 64 | 41 | 25 |
| Adult population within the catchment area | 1,279,300 | 818,600 | 709,400 |

**Figure 5.1.1 Postcode sectors selected for the Forest of Mercia recreation survey**

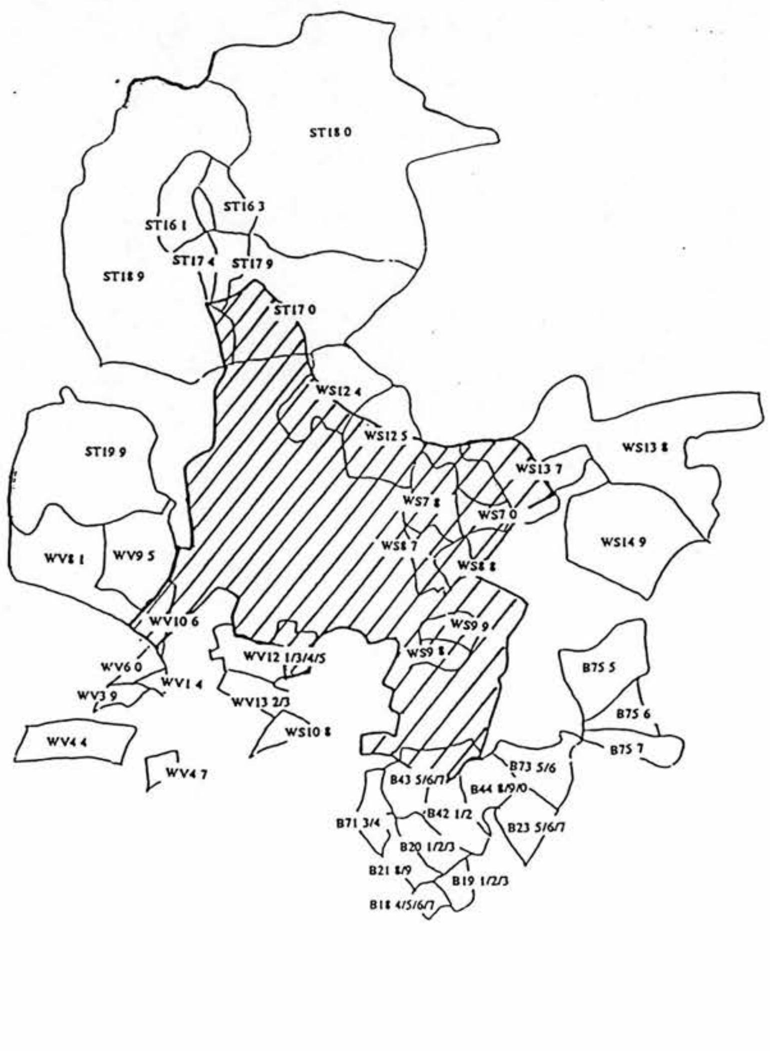


Figure 5.1.2 Postcode sectors selected for the Thames Chase recreation survey

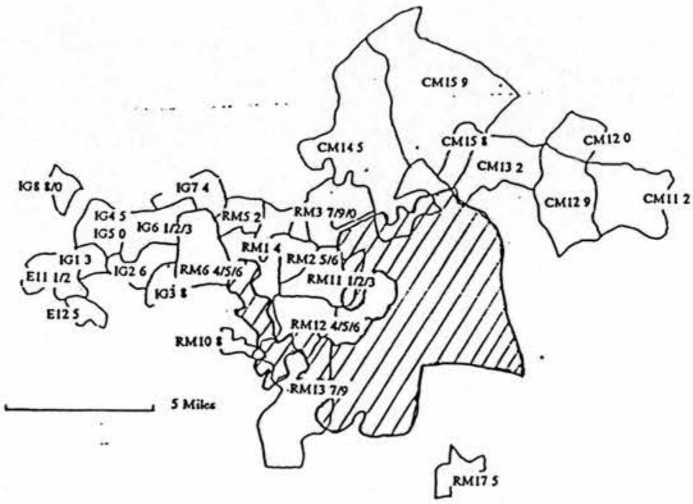
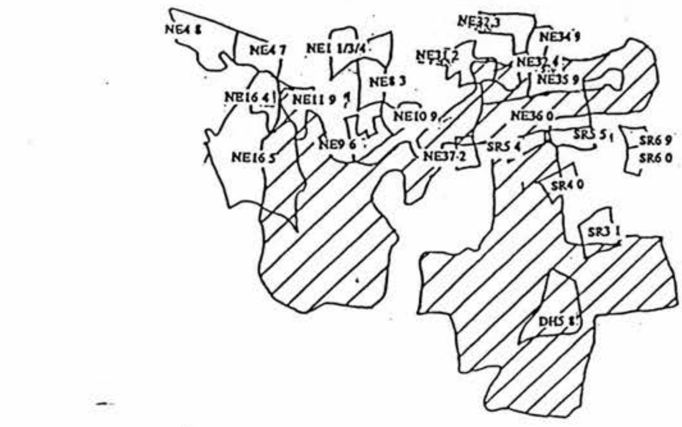



Figure 5.1.3 Postcode sectors selected for the Great North Forest recreation survey



look like and the opportunities they would provide. Project directors were consulted to ensure that the wording was appropriate for each of their areas, and brought out the subtle differences in the aims of each of the forests. They also helped with selection of photographs. One important issue was whether the photographs should contain people or not. Initially photographs had been chosen that would show only what the forest might look like, but a strong case was made for using some photographs including people, on the grounds that in Community Woodlands visitors are likely to see other visitors. It was eventually agreed to have half of the photographs containing people and half not in Forest of Mercia and Thames Chase, and all but one of the photographs in the Great North Forest leaflet containing people. It was suspected that people would react more strongly to, and take more interest in, photographs or views containing people, but whether this biased results in any significant way it is difficult to tell. Even if individual responses were biased, it is possible that biases in each direction would cancel each other out. The Forestry Commission and project directors also used the local press, radio and television to raise general awareness about the community forests and the survey in particular during the survey period in the hope that this would improve the response rate to the survey.

Face to face interviews were carried out by eight interviewers working simultaneously over the period 27 January-9 February 1992. The results were all coded onto computer disk and presented to the Forestry Commission by 12 February 1992. The structured questionnaire used in the survey was designed so that each interview would take about 10 minutes. A copy of the questionnaires used is also given in Appendix 3. The questionnaire was structured as follows.

- Two questions to assess the effectiveness of the information leaflet.
- About 10 questions examining knowledge and use of the existing area as it is.
- Seven or eight questions about potential use of the community forest.
- Five questions to ascertain willingness to pay (WTP) for the community forest.
- Eight questions to assess the socio-economic and demographic characteristics of the respondents.

The questionnaires differed slightly between areas to reflect local circumstances and priorities. Two areas that were of particular concern in the design of the questionnaire were the recall period for existing use of the countryside and proposed use of the community forest, and the format of the WTP question.

Most recreation surveys consist of a rolling programme of surveys throughout the year, and estimate the number of visits to the countryside (or other places) on the basis of a one or two month recall period (see Chapter 4). It was felt that obtaining sensible responses to questions about average use in a year from a single interview could be very difficult, particularly in the middle of winter. Therefore, in an attempt to increase the reliability of the responses each frequency of use question was followed up by asking whether the response was for the whole year or just some months. It was felt that this would restrict any tendency for the long recall period to bias frequency of use responses upwards, and result in a conservative estimate of existing and proposed visitor use. It also revealed the seasonality of proposed and existing use which would be useful for planning facilities to cope with peak demand.[1]

There are many ways of eliciting WTP for a non-market good or service, and a great volume of literature has developed discussing the advantages and problems with each. Four formats for the WTP questions were given serious consideration.

1. a set of payment cards containing different payment bands rotated by respondent;
2. an iterative bidding game starting with alternately very high and very low bids, then working their way down or up rather like in an auction;
3. a discrete choice question where each sample is split into sub-groups that are each asked if they are willing to pay one single amount; and
4. an open-ended WTP question where respondents are asked to give their maximum WTP for provision of the good.

Payment card formats and iterative bidding games are generally easy to administer, but suffer from several biases such as starting point bias and interviewer bias. Discrete choice questions offer the least risk of bias but require large amounts of data and a sample size of 3,000

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Some types of outdoor visit will be recorded more accurately. So for example, dog walkers will know that they visit a local park or open space every day, and sports enthusiasts will know that they might take part in a game of football or cricket once a week during the season. For more informal and less frequent uses of the countryside, frequency of trips is much harder to remember, and it was felt that this line of enquiry was the best way to obtain an accurate estimate of visitor use.

might have been needed instead of 300. Therefore the open-ended WTP question format was finally chosen as being relatively cost-effective and offering only limited scope for bias to enter into the results (for a further discussion of WTP questionnaire design, see Mitchell and Carson, 1989) Two different payment formats were offered to respondents (a payment per month or per visit) and various follow-up questions were added to cross-check the validity of WTP responses.

Because the community forests are difficult to describe adequately in a few words it was thought that respondents would find it easier to visualise what was being proposed if photographs were carried by the surveyors and referred to in several of the questions. The aim was to give respondents a before and after impression of their local countryside, and reduce the number of "don't know" responses to questions in the survey. Project directors supplied photographs which they felt were typical of their area, and these were added to photographs from the Forestry Commission and Countryside Commission libraries to make a collection showing what each of the community forests would look like. Wherever possible, photographs depicting the proposed community forest were selected that would look similar to the existing area in terms of topography, building density and field patterns, but would not be recognised by residents as local parks or beauty spots.

Appraisal of the survey design

A simple measure of the effectiveness of questionnaire surveys is the number of incomplete or unusable returns. Only five respondents in the surveys failed to complete the whole of the interview, so on the whole the questionnaire worked quite well. The sample size of 300 was achieved in all three areas, and although this was quite small (less than 1% of the adult population in each of the areas) it was large enough to get reasonably accurate estimates of WTP and compared favourably with the sample sizes used in similar studies elsewhere.

Analysis of the timing of interviews showed that most were conducted during the day and it was suspected that this might have introduced non-response bias into the sample (ie the non-working population would be over-represented in the sample, which would show up as relatively high numbers of females in the sample, particularly in the 25-34 and 35-44 age group and relatively high numbers of elderly people). Despite assurances from the market researchers that quotas would be used to control for this, they were inadequately applied such that this was indeed the case (Table 5.1.2 compares the age and sex structure for the population in each area to that obtained in the sample). This was considered to be a serious problem because, on the one hand these people have more leisure time than most, which might bias the stated usage of the forest upwards, but they also tend to have low incomes, which might bias WTP downwards. The problem was tackled in the analysis by weighting each of the responses such that responses from demographic groups that were under-represented in the sample were given more weight than those from groups that were over-represented in the sample. This relied on those individuals in the sample from under-represented groups being fairly representative of their group, which may not be the case, but this was the only way in which non-response bias could be taken into account.

Table 5.1.2 Demographic structure of the samples compared to the population of each of the lead forest areas

Percentage in each of the demographic groups

| Demographic group | Forest of Mercia | | Thames Chase | | Great North Forest | |
|---|---|---|---|---|---|---|
| | Sample | Pop. | Sample | Pop. | Sample | Pop. |
| Males | | | | | | |
| 17–24 | 6.9 | 7.9 | 3.6 | 7.6 | 0.7 | 7.4 |
| 25–34 | 6.3 | 10.2 | 3.9 | 10.1 | 5.8 | 9.9 |
| 35–44 | 8.2 | 9.1 | 5.2 | 8.9 | 10.5 | 8.8 |
| 45–54 | 6.3 | 7.6 | 7.5 | 7.1 | 8.1 | 7.4 |
| 55–64 | 7.2 | 6.7 | 4.9 | 6.3 | 5.8 | 6.8 |
| over 64 | 11.8 | 7.6 | 17.0 | 7.9 | 9.8 | 7.8 |
| Females | | | | | | |
| 17–24 | 5.9 | 7.6 | 0.7 | 7.6 | 3.7 | 7.4 |
| 25–34 | 17.4 | 9.7 | 5.9 | 10.1 | 11.5 | 9.6 |
| 35–44 | 7.6 | 8.7 | 13.8 | 8.9 | 15.6 | 8.6 |
| 45–54 | 9.9 | 7.3 | 13.4 | 7.3 | 9.5 | 7.3 |
| 55–64 | 9.5 | 6.6 | 10.5 | 6.6 | 11.2 | 7.1 |
| over 64 | 3.0 | 11.0 | 13.4 | 11.6 | 7.8 | 11.8 |

Table 5.1.3 Proportion of respondents that had read the information leaflet

| Level of attention | Forest of Mercia | | Thames Chase | | Great North Forest | |
|---|---|---|---|---|---|---|
| | Number | % | Number | % | Number | % |
| Read the leaflet fully | 110 | 36 | 96 | 32 | 107 | 36 |
| At least glanced at it | 103 | 34 | 113 | 37 | 157 | 53 |
| Not read it at all | 94 | 30 | 96 | 32 | 30 | 10 |

Table 5.1.4 First source of information about the community forest

| Source | Forest of Mercia | | Thames Chase | | Great North Forest | |
|---|---|---|---|---|---|---|
| | Number | % | Number | % | Number | % |
| Information leaflet | 92 | 30 | 147 | 48 | 232 | 79 |
| National press | 15 | 5 | 17 | 6 | 3 | 1 |
| Local press | 62 | 20 | 28 | 9 | 17 | 6 |
| Radio | 6 | 2 | 1 | 0 | 1 | 0 |
| Television | 4 | 1 | 12 | 4 | 9 | 3 |
| Word of mouth | 0 | 0 | 17 | 6 | 3 | 1 |
| Not heard of it | 119 | 39 | 79 | 26 | 25 | 8 |
| Other | 6 | 2 | 2 | 1 | 0 | 0 |

The questionnaire examined the effectiveness of the information leaflet as a pre-interview briefing tool and Table 5.1.3 shows the number of people that had read the leaflet before the interview. It can be seen that about two-thirds of respondents had at least glanced at the leaflet, suggesting that was quite successful at raising respondents' awareness of the community forests.

There is evidence to suggest that the response to contingent valuation or willingness to pay (WTP) questions can be positively correlated with the amount of information provided about the resource that is to be provided (eg Hanley and Munro, 1991). However, it was felt to be appropriate to provide respondents with information in this case for several reasons.

1. Most contingent valuation studies are carried out within the framework of an existing resource such as a beach, river or forest. Respondents are often questioned on site, and they usually have some information from their own experiences about what the resource provides for them. This is not the case in the community forests, which are a totally new concept in the Britain.
2. Respondents were generally unaware of the community forests, which would have led to many "don't know" responses and wasted survey resources had this information not been provided. Table 5.1.4 shows where respondents first got to hear of the community forest and it can be seen that in most cases, this was from the information leaflet.
3. Providing that people are correctly informed, informed responses are likely to be more reliable than uninformed responses.

The variable recording whether the respondent had read the leaflet or not was examined to see if there was any correlation between this and WTP so that any systematic bias if found could be taken into account. However, this did not show any significant link between the respondent having read the leaflet and WTP, suggesting that this sort of bias was not a problem in the survey results.

The survey of residents in Red Rose Forest

The survey of Red Rose Forest (in Greater Manchester) was undertaken some time after the surveys in the lead Community Forests, so the problems highlighted above were taken into account in the survey design. Red Rose Forest comprises the six westernmost districts of Greater Manchester (Bury, Bolton, Trafford, Salford, Manchester and Wigan) with a population of about 1.6 million, and this was taken as the sampling frame from which to draw a sample of residents for the survey.

The aim of the survey was to collect similar information as before about existing and proposed use of the forest, but instead of asking about WTP for the creation of the forest, the survey examined preferences for different levels of forest cover using photographs of the area. A further aim of the survey was to study the effectiveness of an information campaign in the local press (reported in Whiteman, 1994b) so surveys were carried out before and after information was presented to local residents. Key survey dates were as follows:

1. 12 Dec 93 to 20 Dec 93 : First Survey
2. 27 Jan 94 to 03 Feb 94 : Information Campaign

3. 29 Jan 94 to 11 Feb 94 : Second survey

4. 05 Mar 94 to 21 Mar 94 : Third survey

The second survey was only started in areas after the information campaign had been completed.

A random sample was selected by taking a random individual from the first *n* individuals followed by every *nth* individual from the electoral rolls of each of the six districts (where *n* was set to give the desired sample size). The sample size was set at 1,000 individuals for the first survey and 500 individuals for each of the other two surveys. Face to face interviews were conducted as before with individuals in their own homes. Where respondents were not home, interviews were conducted with other individuals in the household, or in households either side of the specified address and quotas were set to control for non-response bias on the basis of age, sex and ethnic origin of the respondents. These were effective and resulted in a sample that was within 3% of the population in each of these demographic groups such that weights were not needed for the analysis of results. Because of the greater complexity and time involved in handling the landscape preference questions, only 270 respondents in the first survey were asked to take part in this part of the survey.

A similar structured questionnaire to that used before was used in this survey (see Appendix 3) and results were coded onto a mixture of paper questionnaires and hand held data processing units. Questions on landscape preferences replaced questions about WTP in the surveys in the three lead forests. The biggest change in this survey was in the way in which questions about existing and proposed use of the area for recreation were asked. Respondents were simply asked to give the frequency of visits they made to the area (or would make to the forest) in Summer (defined as April-September) and Winter (October-March). This was done because the earlier surveys showed that most respondents answered for the whole year or a group of 6 months or so which fitted in roughly with these periods. It also followed the convention started in the general household surveys in 1992 (not reported earlier) which seemed to be successful.

Selection and use of photographs for the landscape preference survey

The aim of the landscape preference part of the survey was to examine residents' preferences for different levels of forest cover in the Red Rose Forest area. An earlier consultant's report (Woolerton Truscott, 1992) indicated that there was quite a wide range of landscape types in the area and it was suspected that preferences for different levels of forest cover may be different in each of these types of landscape. So, the five landscape types covering the largest part of Red Rose Forest (moorland; rolling farmland; low lying farmland, rural fringe, and urban fringe) were selected and panoramic photographs from 10 randomly selected locations within each of these landscape types were taken. Many of these photographs had restricted views mostly due to buildings, but for each of the landscape types, three locations had a reasonable depth and field of view into which different levels of forest cover could be superimposed. A professional photographer was then commissioned to take high-quality photographs of the landscape at each of these locations and the best of these (in terms of the quality of the photograph) were selected to give one photograph of each of the landscape types.

These photographs were then digitally scanned by Forestry Commission landscape technicians and blocks of woodland from these photographs were replicated to give the impression of different levels of forest cover (see Appendix 3 for examples of the photographs used). Again this was done randomly, taking into account the depth and field of view of the photographs. This process was quite complicated and involved the following stages:

1. Aerial photographs and 1:10 000 OS maps were used to estimate the location of woodlands and current level of forest cover in each of the views, and this data was transferred to maps.
2. The average block size was then replicated at random points across the maps of each view and at random distances to the location from where the photograph was taken. Where points were close to one another, they were converted into larger blocks of woodland, and all blocks were shaped so as to meet Forestry Commission landscape guideline standards. The two higher levels of forest cover considered in the analysis were 20% and 30% cover.
3. The maps of each of the three levels of forest cover within each landscape type were then digitised and draped across a topographical background within a geographical information system (GIS) so that view in perspective which matched the photographs could be produced, and this was used to direct the addition of new woodland within each of the photographs.

This process took quite a long time and further research is now investigating using computer generated pictures of woodland for this sort of analysis.

Having generated 15 photographs of 5 different landscape types and 3 different levels of forest cover (the photographs were all exactly the same size and had similar fields of view) the next point to consider was how these should be presented to respondents. It was felt that presenting respondents with all 15 photographs would be too much for them to take in during a relatively short interview. It was also felt that presenting them with one or two of the landscape types and all three levels of forest cover might make it more like a test for them to guess the correct order (ie high, medium and low) of forest cover, which could bias the results. It was decided therefore, to present respondents with six photographs (a manageable number) containing two pairs of two of the landscape types with different levels of forest cover, and two randomly selected photographs of different levels of forest cover in two of the other landscape types. With three different possible high, medium and low comparisons within each pair and ten different combinations of pairs of photographs, a schedule of photographs was drawn up and used in the survey such that each of the 90 possible combinations of two pairs were shown three times and each photograph was shown an approximately equal number of times in the survey. This gave a large number of comparisons of different levels of forest cover for each landscape type and a reasonably large number of comparisons between landscape types (with forest cover held constant).

Respondents were asked to rank the 6 photographs from most to least preferred as a landscape in which to live. The exact wording of the question was as follows:

> "Here are 6 photographs of the Red Rose Forest area" (select 6 of the 15 photographs as in the photograph schedule, and place next to each other on a flat surface such as a table or board).

"Thinking about the nearest open space to where you live, I would like you to study these and put them in the order in which you would most prefer that area to look like. Please take as long as you like and feel free to move the photographs around if that will help you."

The statement that they were making a choice about a landscape in which to live was very important because as Lee (1990) shows, preferences for different landscapes can be strongly affected by the suggested purpose to which the landscape will be put.

Consideration was given both to ranking and to scoring the photographs as methods of eliciting preferences. Scoring would have been preferable to ranking because it would have introduced quantities into the analysis which could have been analysed more easily using standard statistical techniques. It was felt though, that this sort of judgment would be too difficult for respondents to make in the survey. Lee argues that quantitative assessments (ie scoring) of landscapes can be made by members of the public, but he also recommends that this be done with the aid of a response board so that respondents can make careful and considered judgments as to the relative merits of different landscapes. The request that the photographs be put onto a flat surface and freely moved around had some of the qualities of the response board approach (making it easier to make comparisons) but it was felt that this would still be inadequate for accurate scoring purposes, so it was decided to ask respondents simply to rank the photographs in this study.

In an attempt to examine another way of soliciting WTP bids for the creation of the forest respondents were also asked to state if they thought it would affect the value of their house, and give an estimate of what they would be willing to pay to buy or rent a similar house in two of the locations shown (in the same landscape type but with different levels of forest cover).

## Conclusions

This section has described how surveys were used to collect data on existing use of the countryside, proposed use of community forests, WTP for the creation of community forests, and landscape preferences. It has shown how non-response bias can be a problem in such surveys and discussed the problem of eliciting frequency of use using a long recall period. It has also discussed some of the difficulties of generating and using photographs to test landscape preferences.

## 5.2 INFORMATION COLLECTED ABOUT RECREATION IN THE FORESTS

The surveys asked respondents about how well they knew the community forest area, how often they used it for recreation, the extent to which the area met their needs, their views on its appearance, and their likely use of the forest. (To aid this, a map of each community forest was shown to respondents as part of the survey - see Appendix 3). Existing use questions were asked to encourage them to think about substitutes for the forests, and to assess the level of information on which they would be basing their answers. This section discusses the answers to these questions and compares the proposed use figures to those obtained from the recreation model described in Chapter 4.

### Knowledge and use of the existing area

One of the first questions in the survey asked respondents about how well they knew the area, and Table 5.2.1 shows the responses to this question. Residents in Forest of Mercia and Red Rose Forest claimed to have a greater knowledge of the local area than residents in the other two forests. This difference was statistically significant (at the 5% confidence level) and it was suspected that it may have arisen because the very large area of these two forests meant that more people might be familiar with at least part of them.

Respondents in the three lead forests were also shown photographs considered to be typical of the local area (in case they had not read the information leaflet), and were asked whether they thought the photographs gave an accurate impression of the local area. Nearly all respondents agreed that they did, and those that did not were mainly

Table 5.2.1 Respondents knowledge about the local area in each of the community forests surveyed

All figures are percentages

| Level of knowledge | Forest of Mercia | Thames Chase | Great North Forest | Red Rose Forest | |
|---|---|---|---|---|---|
| | | | | Survey 1 | Surveys 2 & 3 |
| Don't know the area | 10 | 20 | 11 | 10 | 5 |
| Know a little about it | 26 | 36 | 44 | 23 | 20 |
| Know it quite well | 40 | 27 | 34 | 43 | 48 |
| Know it very well | 24 | 14 | 11 | 21 | 28 |

Table 5.2.2 Ratings of each of the areas in terms of meeting local outdoor recreation needs

All figures are percentages

| Rating | Forest of Mercia | Thames Chase | Great North Forest | Red Rose Forest | |
|---|---|---|---|---|---|
| | | | | Survey 1 | Surveys 2 & 3 |
| Doesn't meet needs | 14 | 26 | 16 | 23 | 11 |
| Meets some needs | 33 | 18 | 55 | 23 | 22 |
| Meets most needs | 33 | 23 | 30 | 25 | 49 |
| Meets all needs | 17 | 15 | 3 | 11 | 14 |

respondents who had already admitted to knowing little or nothing about the area. Respondents in Thames Chase showed less agreement (77%) that the photographs were accurate and it was suspected that this was due to one particularly unattractive photograph taken in the area. However, on the whole, the responses confirmed that the photographs were quite accurate and usefully served to remind people about what the area currently looked like.

Respondents were asked directly how well the area met their recreation needs (Table 5.2.2). Residents were most satisfied with the existing area in Forest of Mercia and Red Rose Forest and least in Great North Forest. It was difficult to interpret these results, although it was thought that the existing supply of outdoor recreation resources could be one explanation for this difference. They were then asked about their current use of existing outdoor resources. Responses were coded and grossed-up to give the annual numbers shown in Table 5.2.3. Weighted means were calculated for the three lead forests to counteract possible non-response bias in the sample and give a more accurate indication of the average number of visits made by the population of each catchment area as a whole.

In Forest of Mercia and Great North Forest, the weighted answers were lower than the unweighted answers probably because non-response bias led to an oversampling of people at home during the day, who have more leisure time than those that were not in when the interviewer called. Weighting the answers lowered the results only slightly though, suggesting that non-response bias was probably not a great problem in these forests. In Thames Chase however, the difference between weighted and unweighted results was in the opposite direction and much greater in magnitude. This was almost certainly due to the large number of people over 64 years old in the sample. Earlier chapters showed that participation in outdoor activities declines with age, so the correction for non-response bias was more important in this case.

The ranking in terms of existing participation in outdoor recreation put Red Rose Forest first by a large margin followed by Thames Chase, Forest of Mercia and Great North Forest. The sample from Red Rose Forest showed levels of visitor numbers 50-100% higher than Thames Chase to three to four times the level of numbers recorded in Great North Forest. Many possible explanations could be put forward to account for this difference, such as the different distribution of socio-economic groups in these communities, varied tastes towards the countryside, different levels of existing resources and levels of accessibility. It was also suspected that the different way in which the question about participation was asked in Red Rose Forest could account for some of this difference. The distribution of participation rates for activities showed that many respondents reported zero or near zero participation, but it also had a long tail stretching to a few participants who claimed to make a visit every day. The presence of a few very frequent visitors reduces the confidence attached to the mean of the sample because any uncertainty about the few very high recorded participation rates could have a significant effect on the estimated mean. However the weighted mean is the most appropriate basis on which to gross up sample responses to total visitor numbers (this is also shown at the bottom of Table 5.2.3), although the large differences between the forests suggested that these results should be treated with some caution.

Table 5.2.3 Existing use of outdoor recreation resources and proposed use of the forest

Figures are number of visits per person per year except implied total visitor numbers (at bottom)

| Activity | Forest of Mercia | Thames Chase | Great North Forest | Red Rose Forest Survey 1 | Red Rose Forest Surveys 2 & 3 |
|---|---|---|---|---|---|
| Visit local park | | | | | |
| Mean | 20.5 | 28.9 | 18.9 | 54.9 | 42.7 |
| Weighted mean | 18.4 | 30.1 | 17.8 | – | – |
| Visit named substitute | | | | | |
| Mean | 3.8 | – | 0.3 | – | – |
| Weighted mean | 3.6 | – | 0.3 | – | – |
| Watch/play sport | | | | | |
| Mean | 4.3 | 4.7 | 2.2 | 21.9 | 11.1 |
| Weighted mean | 4.8 | 6.4 | 2.2 | – | – |
| Visit local countryside | | | | | |
| Mean | 3.3 | 7.8 | 0.9 | 17.7 | 14.2 |
| Weighted mean | 3.2 | 11.5 | 0.8 | – | – |
| Visit distant countryside | | | | | |
| Mean | 2.8 | 2.6 | 0.6 | 10.9 | 6.0 |
| Weighted mean | 2.6 | 3.2 | 0.4 | – | – |
| Other outdoor activity | | | | | |
| Mean | 3.9 | 3.4 | 3.6 | – | – |
| Weighted mean | 5.0 | 3.6 | 4.1 | – | – |
| Total | | | | | |
| Mean | 38.6 | 47.4 | 26.5 | 105.4 | 74.0 |
| Weighted mean | 37.6 | 54.8 | 25.6 | – | – |
| Proposed use of forest | | | | | |
| Mean | 16.9 | 17.3 | 12.5 | 32.7 | 18.5 |
| Weighted mean | 15.7 | 18.6 | 14.5 | – | – |
| Implied total number of visits per year (millions) | | | | | |
| To existing resources | 48 | 45 | 18 | 166 | 116 |
| To the forest | 20 | 15 | 19 | 52 | 29 |

Note: named substitutes were Cannock Chase in Forest of Mercia and Chopwell woods in Great North Forest

Table 5.2.4 Visitor numbers to community forests predicted from the recreation models developed in Chapter 4

In millions of visits per year

| | Forest of Mercia | Thames Chase | Great North Forest | Red Rose Forest |
|---|---|---|---|---|
| Proposed forest area (ha) | 5,656 | 2,000 | 3,680 | 10,000 |
| Predicted numbers | | | | |
| using 1989 model | 2.2 | 0.5 | 1.1 | 3.5 |
| using 1990/91 model | 6.9 | 4.4 | 4.4 | 12.6 |

Proposed use of the forest

Following the questions about use of the existing area, respondents were then shown photographs of what the forest would look like (except in Red Rose Forest) and were asked a further question about how often they might use it. Responses were converted to annual visitor numbers in the same way as before and are also shown in Table 5.2.3. The number of respondents answering that they would visit the forest very often was generally very high compared to the answers given about use of the existing area. Whether this was because respondents appreciated that the community forest will be very close to them or whether it just reflected good intentions on the part of respondents (that may not materialise into visits in the future) it was difficult to say.

Table 5.2.3 also shows the total number of visits that these results implied for each survey area as a whole. These figures were very high in comparison to the results of other forest recreation surveys, but it must also be noted that the surveys gave no lower boundary to the duration of a visit so many expected visits might be of only short duration (this is particularly likely in the case of respondents who said they would make a visit very frequently).

The survey area was defined as within and up to 5 miles outside the community forest boundary in the three lead forests and within the forest boundary in Red Rose Forest. This was based on the belief that individuals would only be prepared to travel short distances to use local environmental facilities for (quite often) short periods of time. While it is possible that some visitors will come to these forests from outside the catchment areas, it was felt that this would be unlikely and would not add to visitor number significantly.

A final question in this section then asked respondents that thought they would never visit the forest why this might be the case. Of those 3hat said they would never visit the forest, the most common reason given was that the respondent does not go out any more (usually due to old age or disability), but a significant minority in the Red Rose Forest area also said that they were not interested in or did not like forests (25% of respondents not visiting). Ninety per cent of respondents said they would be likely to make their visits by car, and the range and distribution of activities in the forest recorded in the surveys were very similar to those reported for general forest recreation in Chapter 4 (full tabulations of the responses to the questionnaires are given in Whiteman and Sinclair, 1994 and Whiteman, 1994).

Community forest visitor numbers estimated using the recreation model developed in Chapter 4

As a cross-check on the rather high visitor numbers estimated in these surveys, the recreation models developed in Chapter 4 were used to forecast visitor numbers on the basis of the area and location of the proposed community forests. The results of using the models generated from the data in 1989 and 1990/91 are shown in Table 5.2.4.

Using the model generated from the 1989 data, predicted visitor numbers were very low, generally only 10% of the number of visits stated by respondents to the surveys. This was because the model generated using the 1989 data had a quite low coefficient on the distance weighted forest area variable, such that the proposed increase in forest area in these locations had only a slight effect on predicted recreation participation. The 1989 model was based on visits of more than 3 hours duration, so it was felt that this was not an appropriate model to use because it would estimate the total number of visits of any duration, which would be a more accurate estimate of total visitor numbers to community forests (where it would be expected that many visits would be of a quite short duration).

The results from using the 1990/91 model were higher, but still only about one-third the level of visitor numbers estimated from the responses to the community forest surveys. Because this model was based on visits of any duration, it was felt that these figures would be a more accurate estimate of likely visitor use of the forests. It was interesting therefore, that comparison of these figures with the responses stated in the survey suggested that the latter may have been biased by overoptimism on the part of respondents. The bias was also very large, with stated responses being about three times the levels predicted by the model.

Conclusions

This section has discussed the results obtained on satisfaction with and use of the existing community forest areas for recreation. About 30-50% of residents in the forests suggested that the areas met most or all of their recreation needs implying that, for the majority, the areas could be improved. Existing levels of recreation were broadly comparable with the results obtained in similar surveys such as the National Countryside Survey (see Chapter 4), although the large difference between results obtained in Red Rose Forest and the other forests suggested that these should be treated with some caution.

The average numbers of visits respondents said they would be likely to make to the forests were quite large at 13-17 visits/year in the three lead forests and 19-33 visits/year in Red Rose Forest. When these were compared to the levels of visitor numbers generated using the recreation model (based on 1990/91 data) developed in Chapter 4, they were found to be about three times larger than the model predictions. It was felt that this was likely to be due to optimism bias on the part of respondents, although the magnitude was surprisingly large such that the model predictions should probably only be treated a minimum estimate of future visitor numbers.

## 5.3 VALUATION OF COMMUNITY FOREST BENEFITS

One of the most important parts of the survey of the three lead forests was the direct questioning of respondents about the value they placed on their creation. This section describes how the questions about value were framed and the results obtained were analysed and tested.

### Willingness to pay for the creation of the forests

The different ways of estimating the value of unmarketed products were discussed in Chapter 2. Because the community forests were proposed developments, it was not possible *ex ante* to use revealed preference techniques to estimate the value of their creation. It was decided therefore, to use the contingent valuation technique, or direct questioning of residents, to attempt to estimate the value of the most conspicuous (ie recreation and landscape improvement) outputs of the three lead forests. The contingent valuation technique involves asking respondents either how much they would be willing to pay to obtain or preserve the availability of a resource, or alternatively how much compensation they would require to allow it to be taken away. Because, in the case of the community forests, the proposal was to create a new resource, it was felt that the willingness to pay (WTP) to obtain the benefits the forests would provide was the most appropriate format to use in this case.

The main problem with the contingent valuation approach is its hypothetical nature (see Chapter 2 for a fuller discussion of the problems of the contingent valuation approach). This, combined with the complex and imprecise nature of many non-market products, makes it difficult to place a great deal of certainty on the results of the approach. Various biases can occur in the questioning of respondents, and to seek to minimise these, the questions on valuation had to be carefully designed (the questionnaire used was shown to several leading researchers in the field of contingent valuation in the UK, and their comments on its design were incorporated in an attempt to get the best design possible). A more fundamental problem however, is to ensure that one is actually measuring the value of the relevant concept. In the case of the community forests, the whole question of access and property rights within the community forests was not addressed in the survey, and this deficiency may give rise to some uncertainty about the results obtained.

Another concern about the technique is the difference between WTP and willingness-to-accept (WTA) compensation results often found in valuations of the same resource. On the whole, WTP questions of the type used in this survey tend to give lower valuations due to factors such as income constraints, so it could be argued that the results give an unduly conservative measure of benefit from the forests than might really be the case. However, WTP did seem to be more appropriate than WTA in this situation because the survey was asking about the value of creating a new resource (rather than taking one away). To overcome some of the problems highlighted above however, tests for validity and reliability were carried out on the results, and these are described in a following part of this section.

After respondents had been given all the information about what the forests would be like and had stated in the survey how often they might use the community forest, they were then asked how much they would be willing to pay to see it created. The question used read as follows:

"The [community forest name] will not generate enough income to be self- supporting. The forest will therefore require support from local councils whose resources would probably have to come from taxes in one form or another. If everyone in the area had to pay for this forest, what is the most you personally would willingly pay to see the project go ahead? Please give me an amount per month or per visit to the forest."

This was followed up with a question that checked whether the response was for the individual or their household, and if the latter was true, asked what the response would be for the individual. It also asked those respondents that were unwilling to pay anything, why that was the case (in order to identify protest responses - a common problem with WTP surveys which will be discussed later).

Respondents were not given any guide (such as payment cards) as to what bid they should make, and were also freely given the option of suggesting a payment per visit or per month. It was felt that this was one of the least biased ways of asking for willingness to pay, because respondents were left to decide what their bid should be without any prompting from the interviewer. There is some evidence in the literature that suggests that the hypothetical nature of such a question might cause people to bid unconsidered amounts, but if they did these would be easily identified and could be removed from the analysis if desired. The distribution of bids, including all zero bids is given in Table 5.3.1. Where respondents gave monthly bids, these were converted to bids per visit on the basis of the number of visits respondents had already said they would be likely to make to the forest. In order to calculate average WTP per visit for the whole population of each catchment area.

| Table 5.3.1 Distribution of WTP bids for the creation of community forests in the three lead forest areas | | | |
|---|---|---|---|
| WTP bid | Forest of Mercia | Thames Chase | Great North Forest |
| £0.00 | 85 | 136 | 150 |
| £0.01 - £0.50 | 100 | 97 | 57 |
| £0.51 - £1.00 | 63 | 48 | 42 |
| £1.01 - £1.50 | 9 | 3 | 6 |
| £1.51 - £2.00 | 16 | 5 | 16 |
| £2.01 - £2.50 | 1 | 1 | 4 |
| £2.51 - £3.00 | 8 | 3 | 4 |
| £3.01 - £3.50 | 3 | 1 | 0 |
| £3.51 - £4.00 | 5 | 0 | 1 |
| £4.01 - £4.50 | 1 | 0 | 2 |
| £4.51 - £5.00 | 2 | 2 | 2 |
| £5.01 - £6.00 | 1 | 3 | 1 |
| £6.01 - £7.00 | 1 | 0 | 0 |
| £7.01 - £8.00 | 1 | 1 | 1 |
| £8.01 - £9.00 | 1 | 0 | 0 |
| £9.01 - £10.00 | 0 | 0 | 0 |
| Average WTP including all zero bids | | | |
| Mean WTP | £0.78 | £0.50 | £0.55 |
| Standard error | (£0.13) | (£0.11) | (£0.12) |
| Weighted mean | £0.77 | £0.51 | £0.47 |
| Median | £0.50 | £0.23 | £0.00 |
| Total number of bids | 297 | 300 | 286 |
| Average WTP excluding protest zero bids | | | |
| Mean WTP | £1.00 | £0.68 | £0.92 |
| Standard error | (£0.16) | (£0.14) | (£0.18) |
| Weighted mean | £1.00 | £0.71 | £0.81 |
| Median | £0.50 | £0.50 | £0.50 |
| Total number of bids | 231 | 220 | 168 |
| Annual WTP where WTP per visit greater than £10 | | | |
| £2.40 | 1 | 0 | 0 |
| £10.00 | 0 | 1 | 0 |
| £12.00 | 1 | 2 | 2 |
| £15.00 | 0 | 1 | 0 |
| £18.00 | 0 | 0 | 1 |
| £24.00 | 2 | 0 | 1 |
| £45.00 | 0 | 1 | 0 |
| £60.00 | 3 | 0 | 5 |

Some respondents gave monthly bids and said they would never be likely to visit the forest, and some gave monthly bids but indicated a very low level of usage. In these cases it was felt that the WTP question had elicited a valuation of other benefits such as amenity, landscape, and non-use benefits from the creation of the forests rather than the recreation benefit from their creation. It was suspected that all the responses contained an element of valuation of these other benefits, but particularly so where estimated WTP per visit was far from the mean. Where bids were calculated to be greater than £10/visit therefore, these bids were excluded from the calculation of mean WTP per visit and these are also shown at the bottom of Table 5.3.1. Unfortunately, the limited number of these bids prevented them from being fully analysed in the study.

The contingent valuation technique often elicits zero bids due to respondents' reluctance to answer the WTP question rather than them giving a genuine zero bid for the creation or maintenance of the non-market good or service on offer. This can occur for a variety of reasons; for example respondents may not be able to understand the WTP question, they may think it is wrong to put a value on something they consider should be free, or they may find it too difficult to think of a sensible answer. Zero bids that are not genuine zero valuations are called protest bids and are usually excluded from the analysis to reduce downward bias in the estimation of WTP.

Whether a zero WTP bid was a genuine zero valuation or a protest bid, was determined by a follow-up question asking respondents why they gave a zero valuation. Respondents were offered 5 reasons for giving a zero bid, of which the following two were taken to mean that the bid was a genuine zero valuation:

You do not think it is worth paying any more for [community forest name].

You would not use [community forest name].

The distribution of answers to the question about the reason for giving a zero bid is shown in Table 5.3.2. It can be seen that protest zero bids were highest in Great North Forest and lowest in Forest of Mercia. The proportion of total bids that were protest bids was, at a level of about 25% in Forest of Mercia and Thames Chase, acceptable and compared favourably with other studies of this type carried out in the UK. The figure of 40% in Great North Forest was rather high, and it was difficult to explain why the same set of questions posed in this area should elicit so many protect responses (although it was suspected that this might in part have reflected lower income levels in this area becoming entangled in the reasons for giving a zero valuation even though inability to pay was not offered as a reason for giving a zero bid). Excluding protest zero bids from the distribution of all WTP bids, the average WTP was increased, and the average WTP excluding such bids is also shown in Table 5.3.1.

Because average WTP results were weighted by individual responses rather than by the number of visits respondents would be likely to make, it would only be possible to calculate total WTP for the creation of the forests by multiplying average WTP by estimated annual visitor numbers if the distributions of WTP/visit and the expected frequency of visits per respondent were symmetrical and uncorrelated. This was not the case (WTP/visit was negatively correlated with frequency of visit) so the total value of the benefit of creating the forests had to be estimated another way. This was done by calculating the average annual

| Table 5.3.2 Reasons stated in the survey for giving a zero WTP bid | | | |
|---|---|---|---|
| Reason | Forest of Mercia | Thames Chase | Great North Forest |
| Do not think it is worth any more for the forest | 19 | 33 | 31 |
| Would rather see the money spent on other services | 13 | 29 | 48 |
| Would agree to expenditure but not in the form of taxes | 27 | 18 | 24 |
| Would not use the forest | 0 | 23 | 1 |
| Did not think that the WTP question was sensible | 2 | 2 | 3 |
| Don't know/other response | 24 | 31 | 43 |
| Total number of zero bids | 85 | 136 | 150 |
| Genuine zero bids | 19 | 56 | 32 |
| Protest zero bids | 66 | 80 | 118 |
| Protest zero bids as a proportion of the sample | 22% | 26% | 40% |

| Table 5.3.3 Estimated annual WTP per resident for the creation of the community forests | | | |
|---|---|---|---|
| | Forest of Mercia | Thames Chase | Great North Forest |
| Mean | £8.51 | £8.80 | £9.46 |
| Standard error | (£1.04) | (£1.35) | (£1.23) |
| Weighted mean | £7.70 | £9.79 | £8.66 |
| Median | £3.00 | £3.00 | £2.00 |
| Total number of valuations | 231 | 220 | 168 |

value of creating the community forest to each adult resident, by either multiplying their monthly WTP by 12 or their WTP per visit by their expected annual use of the forest, to give the annual benefit figures shown in Table 5.3.3. These could then be multiplied by the total number of adult residents in each area, to give an estimate of the total annual value to the local community as a whole from the creation of each community forest.

<u>Reliability and validity of WTP bids</u>

Criticism of the contingent valuation technique often centres on the reliability of willingness to pay bids. In response to this, economists have studied the different forms of bias that might occur in WTP surveys and have devised ways of minimising or at least detecting some of them. The results of the recreation survey were analysed in this way, and the degree to which different types of bias may be present in the survey is discussed below. A further check on their reliability is to test their validity, and this was done using tests described in Mitchell and Carson (1989), and results of which are also presented below.

Bias occurs where respondents deliberately or accidentally misrepresent their true bids. The most common form of bias is strategic bias, where respondents misrepresent their true willingness to pay in attempt to influence the provision of, or their likely payment for, the good. The most common cause of this is the potential for free-riding or using the good without payment. It was stressed in the question that the payment would be in the form of a local tax paid by all. However, with the high levels of avoidance of local taxes present at the time of the surveys, the possibility of free-riding may have occurred to a small number of respondents. Other research evidence suggests that as long as the free-riding possibility is ruled out as far as possible, strategic bias has neither an upward or downward effect on bids overall. Strategic bias was thought therefore, unlikely to have influenced bids much one way or the other because the WTP question used a bid vehicle which would be relatively difficult to elude.

Compliance bias is where the respondent tries to please either the interviewer or the organiser of the survey by giving them the responses they think they would like to get. A one-way analysis of variance showed that there were significant differences between the responses given to different interviewers in Thames Chase and Great North Forest (F statistics were 5.95 and 16.16 respectively) but not in Forest of Mercia. However, the ranking of mean bids given to each interviewer differed between community forests, leading to the conclusion that other factors such as the general level of affluence in each of the particular locations where the interviewers were working, were more likely to have influenced mean bids rather than the appearance of the interviewers themselves. This should also of course, have been minimised as much as possible by the market researchers in the presentation of the interviewers. Sponsor bias was not thought to be a problem in this case because the sponsor was stated as being the Forestry Commission; an organisation that it was suspected would not provoke either positive or negative attitudes from most of the respondents because they would be unlikely to have ever had any dealings with the Forestry Commission before.

A third more serious form of bias occurs where elements of the interview give information about the "correct" value of the good. This is usually only a problem where respondents are asked to value several goods at once (where the order in which they are listed may imply importance and hence value to the respondents) or are given pre-coded ranges of answers. This was not a problem in this case because the questions referred to only one product (the community forest), and respondents were given an entirely open question about willingness to pay.

A fourth category of bias is scenario mis-specification, where the respondent values something other than what was intended. This can happen in three main ways:

1. theoretical mis-specification: where the scenario presented to respondents is incorrect in some way;

2. amenity mis-specification: where the respondent is perceiving a different good to the researcher; and

3. context mis-specification: where the perceived context of the market is different to the intended context.

The first type of scenario mis-specification was thought unlikely to be present in this survey in as much as the scenario presented to respondents was developed by the principal agencies involved with community forests: the Forestry Commission, the Countryside Commission and the community forest project directors. The policies developed in the community forests, and the aims of the project teams were accurately portrayed in the scenarios offered to respondents, and the descriptive material used is shown in Appendix 3 to support this assertion.

Amenity mis-specification may have been more of a problem in the survey because it was genuinely very difficult to portray exactly what effects the community forest would have on respondents. Particularly difficult to convey were the whole range of benefits that the forest would bring the individual (which are much wider than just recreation benefits), the time it will take to provide those benefits, and the effort it will take to enjoy those benefits because of the exact geographical placement of the forest (ie respondents did not know exactly where trees would be planted in relation to where they lived).

On the whole, it was thought that respondents' willingness to pay bids might be on the low side, because they may not perceive all of the benefits of the forests. However, it was not known how they were handling the issue of timing of benefits (ie whether they were stating WTP now for the benefits presented in the pictures, taking into account the fact that it will take several decades to create the forests, or whether they were stating WTP for the mature forests presented in the pictures). The intention was that they were stating a WTP to enjoy the mature forest, and that the build-up of benefits to this level would be taken into account by assuming that the benefits would increase to their stated level as the crop matures. Similarly, it was not known whether the effect of geographical uncertainties biased bids either upwards or downwards. The high number of respondents that claimed they would visit by car suggested that they perceived the forest would be further away than may actually be the case, which might have led to downward bias in the size of bids. A final source of this bias revolves around the question of what exactly they were valuing. Was it the value of the forests for recreation, for the landscape enhancement they would create or both of these factors? The questions were designed to elicit both recreation and landscape value, but the presence of many WTP/visit responses suggested that many respondents may have only been giving a valuation for the recreation benefits they would provide.

The most easily defined, and probably most influential scenario mis-specification bias is context mis-specification. Some issues, such as the method of provision of the community forest, and particularly the question of who would have property rights (eg rights of access) in the community forest were not addressed by the questionnaire. However, it would not be true to say that respondents had any less accurate perceptions about these issues than the sponsors, because the latter have yet to resolve precisely how to implement the projects. It was therefore, likely that any context mis-specification arose as uncertainty rather than bias in this case. A more important issue under the heading of context mis-specification is however, the question of the effect of the payment vehicle and the elicitation question on the stated WTP.

Respondents were told that funding would come from local taxes. The local tax scenario was postulated to reduce the chances of free-riding. In reality, a great deal of funding is likely to come from central Government, and the project teams also wish to raise funds from local businesses and individuals through sponsorship and charitable trusts. If there is greater aversion to paying through local taxes than through these other mechanisms then bids could have been biased downwards. The use of different payment vehicles in a survey is the way in which this is usually examined, but because of the small size of the surveys, this was not attempted. There was therefore, no evidence as to the effect of the payment vehicle on the stated WTP, although it was suspected that bids may have been lower than if, for example, central government funding had been proposed as the main source of funding for these projects.

Testing for validity differs from testing for bias in that the latter seeks to estimate and account for misrepresentation of WTP due to a variety of factors associated with the survey, while the former tries to make sense of the actual results obtained by comparing them to what would be expected from theory or the evidence of other studies. Three types of validity can be assessed: content, criterion and construct validity. Content validity, examines whether the data collected accurately reflects the concept (visitor benefit) that the research is trying to quantify. In contingent valuation studies testing for this usually means making sure that the questionnaire is well designed and asks the right questions. The questionnaire was circulated to several well known researchers in the field of contingent valuation studies, and their comments were incorporated into its design in an attempt to do this (it is also presented in Appendix 3 for further scrutiny).

Criterion validity involves checking whether results are correlated with a parameter that is known to reflect very closely the concept under investigation. In the model of hypothetical willingness to pay, an obvious criterion is the actual market price paid for a similar good. Entrance charges to similar outdoor recreation sites such as National Trust properties in the same locations as the community forests ranged from £0.50 to £5.00 (although many sites were also open to access for free). The stated WTP of £0.70-£1.00 per visit did not therefore, seem unrealistic in light of this data.

Construct validity is easier to assess than the other two concepts. It is a measure of the similarity between the results of the survey and other theoretical or achieved results for the same construct (ie willingness to pay to visit a forest in this case). One part of this is convergent validity which seeks to determine if the results are similar in magnitude to the results from similar surveys. Unfortunately these were the first surveys of their type, so there were no similar surveys to compare them with. However there have been surveys of visitors to existing sites, and to the extent that it would be expected that the results would be same, these produced a test of convergent validity. Willis *et al* (1988 and 1989) examined WTP at 14 forest sites and Hanley and Ruffel (1991) at 60 forest sites and their results were shown in Table 2.3.2. More recent work by Bishop (1992) and Maxwell (1992) at sites very similar to those proposed as community woodlands also came to light during the course of the work, and were also presented in Table 2.3.2 for comparison. The fact that mean WTP was of the same order of magnitude as the results obtained in these other surveys suggested that the results of this survey passed the test of convergent validity.

A second part of construct validity is theoretical validity, which tests whether the results can be explained by economic theory. This is usually done by regressing or analysing in some other way, the WTP results against other collected data that would be expected to influence WTP. The variables that might explain WTP can be split into three broad groups:

1. the characteristics of the forest: its attractiveness, accessibility, the provision of facilities and amount of congestion;

2. the nature of the visit: a day trip, a short trip to walk the dog, a visit to have a picnic or barbecue; and

3. the characteristics of the visitor: their sex, age, income, tastes, education, and any other relevant socio-economic variables.

It was quite difficult to test for theoretical validity because only a small amount of supporting data was collected in the survey that might help to explain the variance in WTP. The characteristics of the forest were not available because the forests had not been planted yet, and even so, the forests should not be so different that this would be a significant explanatory variable. Data was collected however, on intended use of the forest, and on several characteristics of visitors which could be used to test theoretical validity. The following characteristics were examined to see if they helped to explain the variation in WTP between respondents: age; sex; household income; membership of a conservation organisation; household size; tastes (as measured in the questions on satisfaction with the existing area and current use of the countryside); car ownership; and distance to the forest, and the results of the analysis of these variables is shown in Table 5.3.4.

The process of accepting or rejecting variables in a regression model is subjective and requires careful judgment. In this case, the only variables that were *a priori* strongly suspected to influence WTP were household income, and tastes, as reflected in satisfaction with the existing area, existing use of the countryside and distance from the forest. The coefficient on household income had the correct sign in

Table 5.3.4 The regression analysis of WTP as a test of the theoretical validity of the WTP results

Dependent variable: Annual WTP for the creation of the forest

| Variable | Forest of Mercia | | Thames Chase | | Great North Forest | |
|---|---|---|---|---|---|---|
| | Coefficient | t-statistic | Coefficient | t-statistic | Coefficient | t-statistic |
| Constant | 205.16 | 0.19 | 1147.72 | 0.89 | -523.81 | -0.47 |
| Age | 8.48 | 0.97 | 2.33 | 0.20 | 3.05 | 0.32 |
| Sex (Female=1) | -17.37 | -0.08 | 186.96 | 0.59 | 546.99 | 1.98 |
| Household income (6 groups) | 328.21 | 3.75 | 106.64 | 1.15 | 276.78 | 2.00 |
| Member of a conservation group | -335.81 | -0.71 | 1338.67 | 2.78 | 1317.58 | 2.10 |
| Household size | 11.02 | 0.12 | -306.18 | -2.02 | -51.84 | -0.46 |
| Satisfaction with existing area (1=not satisfied to 5=satisfied) | -525.62 | -4.48 | -117.39 | -0.79 | -46.92 | -0.27 |
| Existing use of the countryside (number of visits per year) | 2.47 | 1.89 | 8.25 | 3.64 | 4.39 | 2.54 |
| Car ownership | 330.98 | 0.71 | 561.69 | 1.08 | 99.36 | 0.33 |
| Propsed visit activities | | | | | | |
| Dog walk | 419.70 | 1.44 | 401.65 | 0.97 | -44.37 | -0.14 |
| Waymarked walk | 193.54 | 0.65 | 957.30 | 1.78 | 492.01 | 1.53 |
| Other walk | 270.13 | 0.97 | 105.18 | 0.31 | -299.17 | -0.92 |
| Picnic/barbecue | 895.03 | 2.85 | 651.40 | 1.54 | -281.42 | -1.04 |
| Relax/sunbathe | 52.06 | 0.11 | -373.09 | -0.85 | -176.09 | -0.42 |
| Use play area | 54.97 | 0.17 | 761.42 | 1.70 | 217.12 | 0.76 |
| Watch sport | -62.71 | -0.13 | 1229.69 | 2.01 | -391.58 | -0.25 |
| Play sport | -229.47 | -0.44 | 1105.91 | 1.25 | - | - |
| Attend organised event | 117.44 | 0.25 | -1105.52 | -1.05 | - | - |
| Buy refreshments | 215.79 | 0.24 | -323.79 | -0.58 | -427.88 | -0.99 |
| Ride a bike | -748.04 | -0.83 | 1270.67 | 1.53 | 1175.63 | 1.59 |
| Ride a horse | - | - | 249.68 | 0.17 | 419.57 | 0.42 |
| Go on a forest drive | 16.76 | 0.06 | -755.99 | -1.57 | -25.21 | -0.03 |
| Observe nature | 389.59 | 1.33 | -839.93 | -2.26 | -103.29 | -0.36 |
| Other | - | - | 557.07 | 0.27 | - | - |
| Number of observations | | 227 | | 180 | | 155 |
| Adjusted $R^2$ | | 0.16 | | 0.18 | | 0.14 |

Note: Annual WTP calculated as monthly WTP x 12 or WTP/visit x stated number of visits likely to be made; significant coefficients are underlined.

all three forests, but a disappointingly low t-statistic in Thames Chase. This could in part be due to non-response bias, because many respondents refused to divulge their income level in Thames Chase (70 compared to 3 in the other 2 forests in total). Satisfaction with the existing area (on a scale of 1 = not satisfied to 5 = satisfied) had the expected sign and was significant in Forest of Mercia but not in the other two areas. However, in the other two forests, existing use of the countryside (in terms of the number of visits made) had a significant influence on WTP and the variable had the expected positive sign in all three forests. (It was expected that the coefficient on existing use of the countryside should have a positive sign because greater existing use would reflect tastes in favour of visiting the countryside which should lead to a higher WTP for improvements to the countryside.) Distance from the forest was insignificant in all three areas and only had the expected (negative) sign in Great North Forest. While this was disappointing, it was suspected that it could have been due to the very small range of distances over which the survey was conducted.

Of the other visitor characteristics, membership of a conservation organisation was found to be associated with increased WTP in Thames Chase and Great North Forest, but not Forest of Mercia. Women also recorded a significantly higher WTP in Great North Forest than men, although this was not found elsewhere. The household size variable was tried in all 3 regression models but was only significant in Thames Chase, suggesting (very weakly) that individual rather than household income might have been a better determinant of WTP in that forest. A few of the variables on proposed use of or activities in the forest were also significant in explaining some of the difference in WTP between individuals. (Some of these variables had to be excluded from the analysis because they formed linear combinations of other variables.)

In the regression model, many of the variables were insignificantly different from zero at the 5% level. However, there was no evidence to support the inclusion of all of the variables and, because some of them may be irrelevant, this suggested that the t-statistics on some of the other coefficients might have been low due to multi-collinearity. To overcome this problem therefore, variables were removed from the model if the following conditions were met (following Hanley and Ruffel, 1991):

1. there was no strong prior argument in favour of inclusion;
2. $|t| < 1$; and
3. their removal did not greatly affect other coefficients.

This form of testing down the regression equation represented a compromise between improving the statistical properties of the coefficients (such as unbiasedness and efficiency) and retaining economic principles, from theory, for keeping variables in the model. The result of the regression analysis after unnecessary variables were removed is shown in Table 5.3.5.

One variable that was missing from the regression analysis was number of proposed visits to the community forests. In as much as the WTP results captured direct use values (ie recreation rather than amenity value), it would be expected that WTP would increase with greater proposed use of the forest. However, it was not statistically possible

| Table 5.3.5 The regression analysis of WTP after removal of insignificant explanatory variables<br><br>Dependent variable: Annual WTP for the creation of the forest | | | | | | |
|---|---|---|---|---|---|---|
| Variable | Forest of Mercia | | Thames Chase | | Great North Forest | |
| | Coefficient | t-statistic | Coefficient | t-statistic | Coefficient | t-statistic |
| Constant | 79.44 | 0.17 | 946.73 | 1.86 | –890.02 | –1.51 |
| Sex (Female=1) | – | – | – | – | 559.71 | 2.21 |
| Household income (6 groups) | 321.81 | 3.93 | 138.98 | 1.57 | 276.60 | 2.26 |
| Member of a conservation group | – | – | 1220.60 | 2.58 | 1524.08 | 2.64 |
| Household size | – | – | –212.85 | –1.65 | – | – |
| Satisfaction with existing area (1=not satisfied to 5=satisfied) | –476.46 | –4.42 | –158.46 | –1.11 | –86.54 | –0.55 |
| Existing use of the countryside (number of visits per year) | 2.32 | 1.26 | 8.89 | 3.97 | 4.66 | 2.84 |
| Propsed visit activities | | | | | | |
| Dog walk | 440.84 | 1.96 | – | – | | |
| Waymarked walk | 276.56 | 1.26 | 477.47 | 1.48 | 545.15 | 2.17 |
| Other walk | 281.19 | 1.34 | – | – | – | – |
| Picnic/barbecue | 858.50 | 3.60 | 516.81 | 1.36 | – | – |
| Use play area | – | – | 768.70 | 1.87 | – | – |
| Ride a bike | – | – | 1052.88 | 1.31 | 1322.55 | 1.95 |
| Go on a forest drive | – | – | –848.49 | –2.07 | – | – |
| Observe nature | 365.40 | 1.61 | –785.77 | –2.30 | – | – |
| Number of observations | | 227 | | 180 | | 155 |
| Adjusted $R^2$ | | 0.20 | | 0.18 | | 0.19 |

| Table 5.3.6 Estimated total WTP for the creation of the community forests | | | |
|---|---|---|---|
| | Forest of Mercia | Thames Chase | Great North Forest |
| WTP/visit | £1.00 | £0.71 | £0.81 |
| WTP/person/year | £7.70 | £9.79 | £8.66 |
| Total WTP/year | £9.9m | £8.0m | £6.1m |

to include this as an explanatory variable in the model because many of the figures for annual WTP (the dependent variable) had been calculated as: WTP/visit x number of visits. An attempt was made to estimate the model with only those WTP figures that had been stated as monthly figures included as the dependent variable. However less than 100 respondents in each survey had responded in this way, so a statistically significant regression model could not be constructed and the influence of frequency of visits on monthly WTP could not be examined.

On the whole, the results from the regression analysis were significant enough to suggest that the WTP bids had passed the theoretical test of construct validity. Adjusted R-squared was above the 0.15 level suggested by Mitchell and Carson (1989, p213), and most of the explanatory variables were significant and had the correct sign. The results also passed, with varying degrees of success, the other tests of reliability and validity, suggesting that they could be used as an accurate and unbiased estimate of WTP for the creation of the three lead community forests without too many problems.

Conclusions

The aim of this part of the survey was to provide reliable estimates of the value placed by residents on the creation of community forests in the three lead forest areas. This was done using a contingent valuation survey to estimate the WTP for the recreation and amenity benefits they would provide, and by testing the reliability and validity of the results so obtained.

The average levels of WTP/visit recorded in the surveys were similar to those obtained in surveys of forest recreation elsewhere. The total value of each forest was estimated by using WTP/visit and WTP/month bids to estimate annual value per resident, which was then multiplied by the total number of residents within each of the forest catchment areas (the results of this are shown in Table 5.3.6). Total value was calculated in this way rather than by multiplying the mean WTP/visit by annual visitor numbers because these two variables were correlated. The results indicated that the value of creating the forests in each of the three lead project areas would be about £6-10m/year (on the basis of the photographs and description of the forests given to respondents in the survey). However, because the images presented to respondents were of mature forests, it was thought likely that the stated WTP were valuations given for the benefits associated with mature forests, such that it would be some considerable time before these benefit levels could be counted in total in any appraisal of the projects.

The WTP results passed various tests for validity and were, as far as could be ascertained, reasonably unbiased. The main uncertainty over the results was whether the stated WTP figures were for direct benefits only such as the benefit of visiting the forest, or included allowances for indirect benefits such as landscape enhancement, environmental improvement, habitat creation and community involvement. It was suspected that some of the stated WTP was for indirect benefits as well as the direct recreation benefit from using the forests but it was also thought likely that only part of these benefits would have been captured by the survey.

## 5.4 PREFERENCES FOR DIFFERENT LEVELS OF FOREST COVER

Earlier sections of this chapter discussed the likely use of the community forests for recreation. Thee examined visitor numbers and WTP for the creation of the forests, with respondents being presented information indicating that the target for forest cover in these areas was 30%. This is the official target for the forests and was set by sponsors in the belief that 30% cover would be required to create the significantly wooded landscape necessary for the production of the recreation and landscape benefits which the projects set out to achieve. The target is ambitious being higher than the existing level of forest cover in even the most wooded counties in England and Wales (although the area over which it applies is quite modest).

Because the level of cover is the main variable which would have an effect on the cost of creating these forests, and in light of the fact that it was not set on the basis of any empirical evidence of what the preferred level of forest cover would be in these areas, it was decided to test preferences for different levels of cover in the survey in Red Rose Forest. This section discusses the analysis of those results in terms of their consistency and the preferences expressed by respondents. It then goes on to discuss an alternative way of eliciting WTP that was attempted in this survey, and finishes with conclusions about the levels of forest cover that should be aimed for in the forests.

### Ranking of landscape types and levels of forest cover

Table 5.4.1 displays some basic information about the five landscape views that were used in the study. Each of the landscapes were quite

| Table 5.4.1 Physical characteristics of the landscapes shown to respondents | | | | | | | |
|---|---|---|---|---|---|---|---|
| Landscape type | Total visible area (ha) | Total forest area (ha) | Forest cover (%) | Average block size (ha) | No. of blocks >10ha | Max. visible distance (km) | Field of view (deg) |
| Low-lying farmland | 198 | 20.0 | 10.1 | 1.0 | 0 | 2.0 | 60 |
| Moorland | 286 | 34.5 | 12.1 | 3.5 | 1 | 2.7 | 52 |
| Rolling farmland | 236 | 12.0 | 5.1 | 1.0 | 0 | 2.5 | 70 |
| Rural fringe | 144 | 22.0 | 15.3 | 4.5 | 1 | 1.4 | 73 |
| Urban fringe | 299 | 19.0 | 6.4 | 1.0 | 0 | 2.2 | 65 |

| Table 5.4.2 Overall rankings of landscapes and different levels of forest cover (highest at top) | | | |
|---|---|---|---|
| Average rank | Present cover | 20% cover | 30% cover |
| 2.0 | | | |
| 2.1 | | | |
| 2.2 | | | |
| 2.3 | | | |
| 2.4 | | Roll | |
| 2.5 | | | Moor |
| 2.6 | | | |
| 2.7 | | | |
| 2.8 | | | Roll |
| 2.9 | | Moor | |
| 3.0 | | | |
| 3.1 | | | |
| 3.2 | | | |
| 3.3 | Low/Roll | | |
| 3.4 | Moor | Low | |
| 3.5 | | | |
| 3.6 | | | Low/Rural |
| 3.7 | | | |
| 3.8 | | Rural | |
| 3.9 | | | |
| 4.0 | Rural | | |
| 4.1 | | | |
| 4.2 | | | |
| 4.3 | | Urban | |
| 4.4 | | | |
| 4.5 | | | Urban |
| 4.6 | | | |
| 4.7 | | | |
| 4.8 | Urban | | |
| 4.9 | | | |

different in terms of their topography, levels of existing woodland cover, the total visible area, maximum visible distance, and degrees of human intrusion they displayed.

The low lying farmland landscape was, in quantitative terms, the closest to being the average of the five views (and arguably, in qualitative terms, perhaps the closest to a "typical" British lowland landscape - although this is debatable). The moorland landscape had the great variety of topography, displayed a large visible area and had a quite high level of existing forest cover. The rolling farmland landscape also displayed some topographical variety and had a quite large visible area, but had relatively low existing tree cover and displayed some degree of human intrusion (mainly roads and buildings). The rural fringe landscape displayed the smallest visible area and had the highest existing level of forest cover. It also contained some buildings; but by far the largest display of human intrusion was in the urban fringe landscape (about 25% of the area was covered with buildings). This landscape had the largest visible area and one of the lowest levels of existing forest cover. Additional woodland was randomly placed into each of these landscapes to show the effect of what 20% and 30% woodland cover might look like, and because of topography in some cases, the difference between 20% and 30% cover was not strongly discernable.

Respondents were each shown six out of the total of fifteen photographs, and each photograph was shown roughly the same number of times. The average ranking of the photographs is shown in Table 5.4.2. These rankings displayed an appreciable level of consistency with respect to the different landscape types. The urban fringe landscape was consistently ranked lowest and rural fringe landscape second lowest on average irrespective of the level of forest cover in the photographs. The low lying farmland landscape was given an average rank of about 3.5 which varied little across different levels of forest cover, and the moorland and rolling farmland landscapes were ranked most highly; although there was little to choose between these and the low lying farmland landscape at existing levels of forest cover.

The rankings showed less consistency with respect to the level of forest cover. The average rankings of two of the landscape types (moorland and rural fringe) increased monotonically with increases in forest cover. The average rankings of another two (rolling farmland and urban fringe) increased at 20% cover but fell back at 30% cover (although they were still higher at this level than originally). The notable exception though was the low lying farmland landscape, the ranking of which declined monotonically (but only slightly) at increasing levels of forest cover.

<u>Testing and interpretation of the results</u>

The interpretation of these results was, as with the results of any sort of landscape preference study, quite difficult. At least four possible sources of variation were present in the survey.

1. Variation between respondents (or judge effects);

2. Design effects (ie the different ways in which the photographs were combined to make up each set of six);

3. Variation in non-forest parameters (eg topography); and

4. Variation in forest parameters.

Variation between respondents occurs in all sorts of surveys and is measured by the variance or standard deviation of the results. The way this is usually handled is by hypothesis testing which indicates whether the results show that the effect under investigation is significant (usually by rejecting a hypothesis that the results show no significant effect), and the outcome of a few such tests applied to the results are presented below. Similar tests were also attempted to account for possible design effects on the results.

Variation in forest and non-forest parameters were deliberately introduced into the survey because it was the effect of such variation on preferences that was under investigation. The problem arose here however, of estimating how much of the variation in preferences was as a result of the intended or designed variation in the photographs and how much was due to unintended variation. For example, in terms of non-forest parameters, increased woodland cover also tended to mask roads and buildings so any preference for photographs containing more woodland may have captured preferences for less human intrusion in the landscape as well as or even to the exclusion of preferences for more woodland. In terms of forest parameters, increased woodland cover resulted in changes in scale, unity, diversity and other attributes of the landscape which may have been unintentionally different (ie positive or negative changes) between the different landscape types. Or, to put it another way, the preference for 30% cover over 20% cover, which was recorded in only two of the landscape types but not in the other three may have arisen not because 30% cover would be genuinely less preferred in the latter cases, but because the way that 30% cover was presented in those cases was undesirable and that 30% cover presented in a different way would have been preferred. This can only be judged subjectively.

Five tests for significance and consistency were applied to the results:

1. The significance of each paired comparison between photographs implicit in the data was estimated;

2. The transitivity of preferences for different levels of forest cover was investigated using the paired comparisons of different levels of forest cover in each landscape;

3. The significance of the effect of landscape type and level of forest cover on average rankings was estimated;

4. The correlation between average rankings and not preferences between pairs of photographs was investigated; and

5. A consistency test was applied to the rankings.

Implicit in each set of six rankings were fifteen paired comparisons of photographs, giving a total of 4,020 paired comparisons between photographs for the whole sample. Each possible paired comparison was also made, by 38 respondents in the survey on average. Assuming the independence of irrelevant alternatives (ie that the ranking of one photograph above another by a respondent was independent of the other four photographs shown to that respondent), the strength of preference for each photograph over each of the other 14 could be ascertained from the rankings obtained from the respondents that had been shown each particular pair is their set of six photographs. Table 5.4.3 shows the proportion of respondents shown each possible combination of pairs recording a preference for one of the photographs over the other within each paired comparison. This table is split by landscape type into 3x3 matrices, with the diagonal 3x3 matrices recording the strength of preferences for different levels of forest cover within each landscape type.

To test whether the preferences expressed were significant each cell in the table was compared to a null hypothesis (that each photograph in the pairs were judged equal on average) using the binomial function (ie that the mean number of respondents preferring one photograph over another would be np with variance np(1-p); where n = the number of respondents making the comparison; and p = 0.5 under the null hypothesis). Significant preferences for one photograph over another are shown underlined in the table. Significant preferences for one level of forest cover over another within each landscape type were only obtained in the moorland and urban fringe landscapes. Again, preferences were much stronger between landscape types, the moorland and rolling farmland landscapes were significantly preferred to the others on the whole, and urban and rural fringe landscapes were not preferred to the others.

Transitivity of preferences was examined by looking within each landscape type at the net proportion of respondents preferring one

Table 5.4.3 Preferences between pairs of photographs shown to respondents in the Red Rose Forest survey

Figures show the percentage of respondents shown each possible pair of photographs giving a higher ranking to photographs listed in each column than to photographs listed in each row

| Preferred over | | Preferred photograph | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Landscape type & | | Low-lying farmland | | | Moorland | | | Rolling farmland | | | Rural fringe | | | Urban fringe | | |
| Level of forest cover | | Current | 20% | 30% | Current | 20% | 30% | Current | 20% | 30% | Current | 20% | 30% | Current | 20% | 30% |
| Low-lying | Current | 0% | 53% | 47% | 53% | 66% | 69% | 47% | 70% | 60% | 29% | 32% | 41% | 30% | 21% | 31% |
| | 20% | 47% | 0 | 45% | 68% | 69% | 77% | 53% | 60% | 62% | 32% | 30% | 41% | 27% | 24% | 31% |
| farmland | 30% | 53% | 55% | 0 | 73% | 70% | 71% | 42% | 56% | 63% | 42% | 30% | 58% | 33% | 36% | 37% |
| Moorland | Current | 47% | 32% | 27% | 0 | 75% | 74% | 65% | 69% | 71% | 37% | 37% | 47% | 20% | 35% | 39% |
| | 20% | 34% | 31% | 30% | 25% | 0 | 73% | 40% | 75% | 59% | 29% | 32% | 40% | 14% | 22% | 26% |
| | 30% | 31% | 23% | 29% | 26% | 27% | 0 | 33% | 53% | 41% | 24% | 32% | 32% | 21% | 19% | 21% |
| Rolling | Current | 53% | 47% | 58% | 35% | 60% | 67% | 0 | 54% | 60% | 37% | 49% | 32% | 34% | 28% | 26% |
| farmland | 20% | 30% | 40% | 44% | 31% | 25% | 48% | 46% | 0 | 34% | 21% | 17% | 11% | 14% | 22% | 21% |
| | 30% | 40% | 38% | 37% | 29% | 41% | 59% | 40% | 66% | 0 | 13% | 30% | 21% | 30% | 31% | 21% |
| Rural | Current | 71% | 68% | 58% | 63% | 71% | 76% | 63% | 79% | 87% | 0 | 58% | 57% | 27% | 36% | 21% |
| fringe | 20% | 68% | 70% | 70% | 63% | 68% | 68% | 51% | 83% | 70% | 42% | 0 | 51% | 21% | 26% | 33% |
| | 30% | 59% | 59% | 42% | 53% | 60% | 68% | 68% | 89% | 79% | 43% | 49% | 0 | 7% | 32% | 19% |
| Urban | Current | 70% | 73% | 67% | 80% | 86% | 79% | 66% | 86% | 70% | 73% | 79% | 93% | 0 | 65% | 75% |
| fringe | 20% | 79% | 76% | 64% | 65% | 78% | 81% | 72% | 78% | 69% | 64% | 74% | 68% | 35% | 0 | 26% |
| | 30% | 69% | 69% | 63% | 61% | 74% | 79% | 74% | 79% | 79% | 79% | 67% | 81% | 25% | 74% | 0 |

Significant preferences shown underlined

Table 5.4.4 Net preferences for one level of forest cover over another within each landscape type

Figures show net percentage of respondents preferring one level of forest cover over another from above table

| Landscape type & | Low-lying farmland | | | Moorland | | | Rolling farmland | | | Rural fringe | | | Urban fringe | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| direction of preference | 20%> C | 30%> 20% | 30%> C | 20%> C | 30%> 20% | 30%> C | 20%> C | 30%> 20% | 30%> C | 20%> C | 30%> 20% | 30%> C | 20%> C | 30%> 20% | 30%> C |
| Net preference | 6% | -10% | -6% | 50% | 46% | 49% | 8% | -32% | 20% | 16% | 2% | 14% | 30% | -48% | 50% |

level of forest cover over another (the net proportion was calculated as the proportion ranking one level in a paired comparison higher than the other minus the proportion ranking the pair the other way around). These results are shown in Table 5.4.4.

Respondents showed transitive preferences for different levels of forest cover in all the different landscapes. In the low-lying farmland landscape, 20% cover was preferred to the current level of cover by slightly more than half the respondents shown these two photographs, it was also preferred to 30% cover on average, as was the current level of cover compared to 30% cover (ie 20% > C > 30% where ">" denotes "is preferred to"). However, none of these preferences were significantly different to the null hypothesis (of indifference to the level of forest cover) and the resultant ordering was slightly different to the ordering of average rankings for this landscape. Respondents shown the moorland views gave much stronger preferences for the level of forest cover which were in the order 30% > 20% > C, and were all significant.

The same was true of the rural fringe landscape (except that these preferences were not significant). For the other two landscape types, 20% > 30% > C and, in the case of the urban fringe landscape, these preferences were significant. The ordering of paired preferences therefore matched the ordering of average rankings given to the photographs, with the exception of the low-lying farmland landscape.

Further interpretation involved examining the strength of preferences shown within paired comparisons. In the low-lying farmland landscape, preferences were fairly weak but seemed to indicated a slight preference for 20% cover and a dislike for 30% cover suggesting that up to 20% cover should be aimed for in these area. Respondents shown the rural fringe landscape showed slightly stronger preferences for 20% cover and a very slight preference for 30% cover over 20% cover. However the strength of preference for 30% cover over current cover was slightly less than that for 20% cover over current cover, implying that somewhere between 20-30% was probably ideal.

The most problematical results to interpret were the strengths of preferences exhibited by respondents shown photographs of the other three landscape types. Respondents shown pairs of moorland photographs preferred strongly 20% cover to the current level and 30% cover to 20% cover but did not prefer 30% cover to the current level any more strongly than they did 20% cover. Again this implied that somewhere between 20-30% was probably optimal. Respondents shown pairs of rolling farmland and urban fringe landscapes preferred 20% cover to the current level and even more respondents preferred 30% cover to the current level, but respondents shown 20% and 30% cover preferred the former to the latter. Taking into account the strength of these preferences, the results appeared therefore to be intransitive, so it could not be easily determined whether 20% or 30% cover was the most strongly preferred level of cover overall in these landscapes.

Another way of testing whether landscape type and the level of forest cover had a significant effect on rankings would be to carry out an analysis of variance on the average rankings. Strictly speaking, analysis of variance or ANOVA should only be carried out on cardinal measures (and the ratings were of course ordinal). However, it was felt that ANOVA would give an indication of the significance of the effect of variation between levels of forest cover and landscape types on the ranks given to photographs. The results of an analysis of variance performed on the average rankings given to photographs are shown in Table 5.4.5. These show that landscape type had a very strong influence on ranking (significant at less than the 0.1% level) while the level of forest cover had less of an influence (significant at the 5-10% level), and supported the conclusions reached earlier.

As a further test of the internal consistency of the results, the net preferences between pairs of photographs were compared to the differences in average rankings between pairs. These were strongly correlated ($r = 0.86$) suggesting that the average rankings were very similar in order and magnitude to the net preferences expressed for each paired comparison of photographs, and supporting the assumption of the independence of irrelevant alternatives.

One final test performed on the results was to check the consistency of rankings between judges using the test first suggested by Friedman (1937) and subsequently refined by Durbin (1951), Benard and van Elteren (1953), and Prentice (1979). The test reported in Prentice, takes into account the fact that rankings given by each judge are incomplete (ie they only ranked six out of the possible fifteen photographs) by substituting the average rank given to each photograph into each judge's set of rankings in place of missing rankings to give a complete matrix of rankings. This is then standardised and a row vector of reduced ranks given to each photograph is then calculated and multiplied by the inverse of the covariance matrix of this matrix, and again by the vector of reduced ranks to give a single test statistic. This test statistic is distributed chi-

| Table 5.4.5 ANOVA of the mean rankings given to photographs | | | | | |
|---|---|---|---|---|---|
| Landscape type | | Level of forest cover | | | Mean |
| | | Current | 20% | 30% | |
| Low-lying farmland | | 3.3 | 3.4 | 3.6 | 3.4 |
| Moorland | | 3.4 | 2.9 | 2.5 | 2.9 |
| Rolling farmland | | 3.3 | 2.4 | 2.8 | 2.8 |
| Rural fringe | | 4.0 | 3.8 | 3.6 | 3.8 |
| Urban fringe | | 4.8 | 4.3 | 4.5 | 4.5 |
| Mean | | 3.8 | 3.4 | 3.4 | 3.5 |
| Source of variation | SS | df | MS | F | p-value |
| Forest cover | 0.49 | 2 | 0.24 | 3.34 | <10.0% |
| Landscape type | 5.78 | 4 | 1.45 | 19.89 | < 0.1% |
| Unexplained | 0.58 | 8 | 0.07 | | |

| Table 5.4.6 Number of respondents prepared to answer the question about the effect of planting trees on house prices and number prepared to give a valuation for such a change | | | | |
|---|---|---|---|---|
| Number thinking planting the forest will have an effect on house prices in their area | | Number estimating the value of this effect | | Average stated % increase |
| | | all | zero | |
| Yes | 166 | 113 | 19 | 18.1 |
| No | 30 | 14 | 11 | 1.4 |
| Dont know | 73 | 13 | 4 | 7.2 |
| Total/average | 269 | 140 | 34 | 15.4 |

| Table 5.4.7 Average stated change in house prices in response to changes in the level of forest cover expressed in the Red Rose Forest survey | | | | | | |
|---|---|---|---|---|---|---|
| Landscape type | Change from present to 30% level of cover | | Change from 20% to 30% level of cover | | Change from present to 20% level of cover | |
| Low-lying farmland | -7% | (13) | -18% | (11) | 5% | (9) |
| Moorland | 19% | (9) | 10% | (7) | 6% | (10) |
| Rolling farmland | 7% | (11) | -12% | (7) | 7% | (10) |
| Rural fringe | 3% | (11) | 5% | (14) | -5% | (11) |
| Urban fringe | 23% | (5) | 0% | (6) | 13% | (6) |
| Average | 6% | (49) | -3% | (45) | 4% | (46) |

Note: number of respondents making each comparison shown in parentheses squared with (p-1) degrees of freedom (where p is total the number of photographs used in the survey ie fifteen), and tests against the null hypothesis of no significant consistency between (incomplete) rankings. The test statistic calculated from the photograph rankings in this way was equal to 237.43 which, with 14 degrees of freedom, was significant at less than the 0.1% level and indicated a considerable degree of consistency between respondents' rankings of the fifteen photographs.

<u>Willingness to pay for creation of the forest</u>

As an alternative to the direct (ie through local taxes) WTP question used in the earlier surveys, the Red Rose Forest survey asked respondents how much they would be willing to pay for a similar property to their own in two of the locations shown in the photographs. This was not strictly speaking an hedonic price approach to valuation such as that used by Garrod and Wallis because it relied on stated responses rather than actual house market price data, but it was similar in approach to expert opinion surveys that have been used before to value forestry externalities such as in the National Forest cost-benefit analysis (London Economics, 1992) and in a recent Forestry Commission review of the effect of woodland on property values (John Clegg and Co, 1994).

It was felt that this approach would have a major advantage in that it would reduce the incentive for individuals to mis-state their true valuations of the impact of the project because it would suggest that the benefit could accrue in monetary terms to themselves (except in the case of rented property) rather than be portrayed as an expenditure on their part leading to no financial gain but instead an improvement in their quality of life. On the other hand, it was also suspected that this more indirect approach to WTP might make the question more difficult to answer and lead to more unusable responses (because respondents could not answer the question rather than them objecting to the question in the first place - the more common problem of protest bids in WTP studies).

The WTP question was phrased as follows:

> "It is sometimes suggested that changing the local environment can affect property values. If the Red Rose Forest resulted in more trees being planted and more opportunities for recreation being provided in the nearest open space to you, do you think that would have an effect on property values where you live?"

This was then followed with:

> "You have just ranked these two photographs in order of preference".
>
> (show lower ranked photograph)
>
> "Supposing you were now thinking of buying/renting a property similar to the one you currently live in, what is the most you think you would be willing to pay for it in terms of rent or purchase price if it was in an area that looked like this?"
>
> (show higher ranked photograph)
>
> "And how much if the area was changed to look like this?"

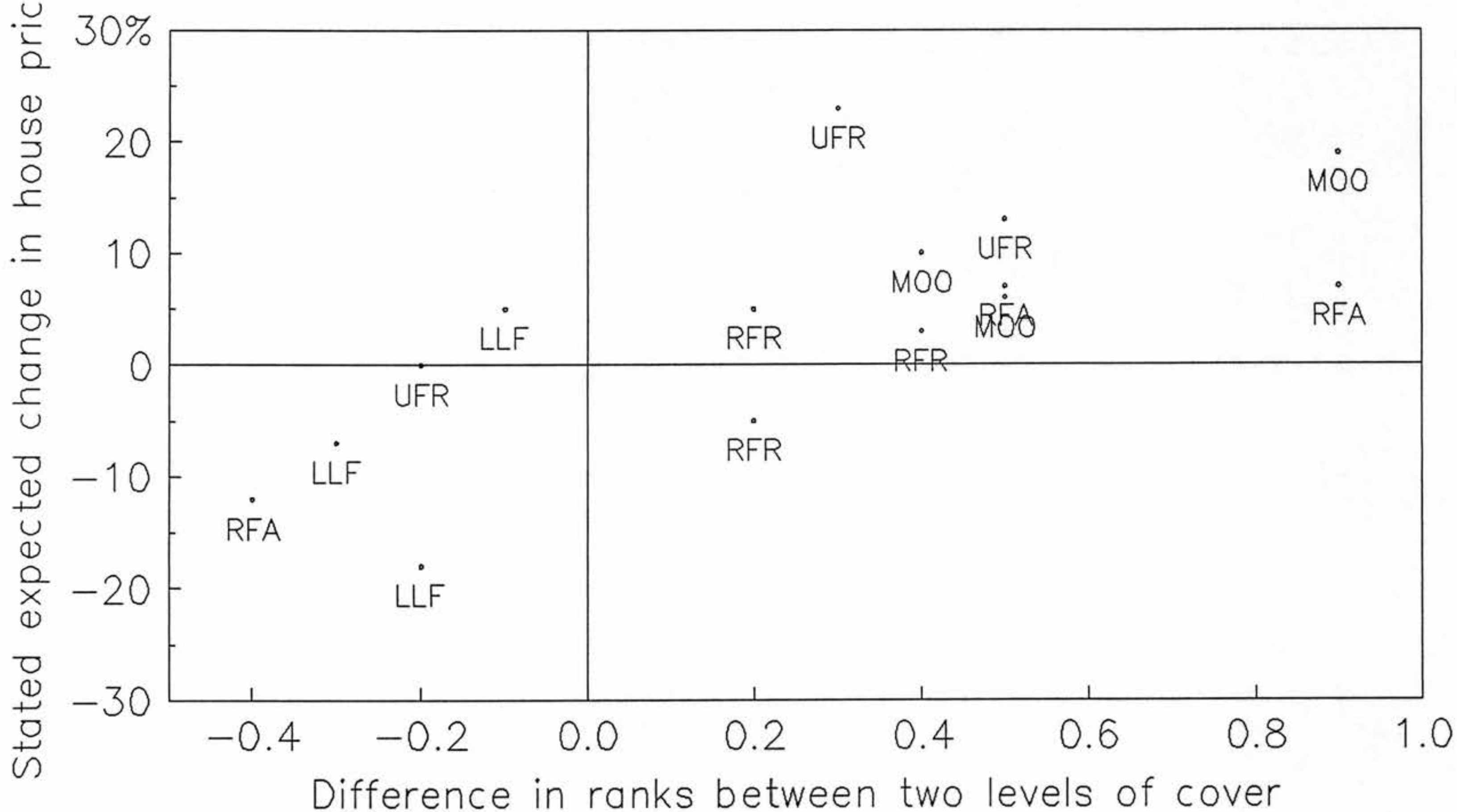
Respondents were free to state rental or purchase price amounts and many gave figures in terms of percentage changes to what they thought the current value of their house might be. Both of these questions were also followed by questions asking them, if they had given zero responses, why that was so. The two photographs selected for the second question were chosen from a second schedule of photographs such that the respondents were shown one of the pairs of photographs (ie of different levels of forest cover in the same landscape type) from the original set of six shown to each respondent.

Responses to the two questions are summarised in Table 5.4.6. About 30% of respondents could not answer the first question about the effect of environmental changes on house prices. Of those that did answer the question, 85% thought that environmental change would affect house prices and the most common reason given for thinking it would not have an effect was that other factors would be more important. Only 50% of respondents were prepared to suggest a value for their property in the two photographs shown to them. Three of the respondents answering that they did not think the forest would affect house prices then went on to give different valuations for their property in the two different landscapes shown to them, indicating some inconsistency in their answers.

Of the respondents that were able to answer the second question, 34 (or 25%) gave exactly the same valuation for property in both landscapes shown to them. When asked why 11 answered that they thought that they already paid enough to their landlord and five answered that they did not think the question was sensible. These were taken to be protest bids, but excluding them from the sample had only a negligible effect on the percentage difference between valuations given to properties in the two photographs shown to respondents. The average percentage difference given to property values in different landscapes by respondents (including all zero differences) was at just over 15%, higher than results achieved in the similar studies mentioned above. However, it was interesting to note that if non-respondents were assumed to have a zero valuation, the difference would have fallen to 7-8% which would have been in line with the results of similar studies; but there was no evidence to support such an assumption. (It is also important to point out that respondents gave valuations in different directions such that the net effect of aggregating responses for the value of one level of forest cover over another was to lower the overall WTP for the most preferred level of forest cover in each landscape.)

The low response rate to this part of the survey suggested that this was probably not a very effective way to format the WTP question because the effect of non-response bias in the sample was potentially quite large. A test of validity however, suggested that those that did give valuations were generally consistent with responses to earlier questions on preferences. This was investigated by comparing the difference between average rankings given to each of the photographs by the whole sample with the average net difference in property values for paired comparisons, of different levels of forest cover given by those answering the property value question. The average stated difference in property values for the three possible comparisons of forest cover and five landscape types used in the survey are shown in Table 5.4.7 and compared with the differences in average rankings (for the same comparisons) in Figure 5.4.1. Differences in WTP and average rankings

Figure 5.4.1 A comparison between average rankings and stated expected changes in house prices between different levels of forest cover



were quite strongly correlated (r=0.715) and regression of the former on the latter suggested that each 0.1 improvement in average ranking of a landscape would result in a 0.5% increase in house prices. This result was significant at the 5% level, but could not be improved by adding other variables that would be expected to affect WTP (such as income, car ownership and estimated current property value) to the bid function. It was therefore only a weak indication of the validity of the results.

## Conclusions

This section has reported the results achieved in a survey of preferences for different levels of forest cover in five district landscape types within the proposed Red Rose Forest. It has discussed different ways in which these results might be analysed, interpreted and tested, and has shown that strong, consistent and significant preferences exist towards different landscapes when they are considered as an environment in which to live. It has also shown that there is generally a preference for a higher level of forest cover than at present in the area. However, it remains unclear as to what the optimal level of forest cover should be in the area.

The limited evidence obtained so far implies that a higher level of forest cover may be preferred in moorland and rural fringe landscapes, than in urban fringe and rolling farmland landscapes, and that there is no strong preference for increased forest cover in the low lying farmland landscape. However, these conclusions have been reached on the basis of only one photograph for each of the landscape types, so it would be wise to repeat the study using different photographs to further test these results before coming to firm conclusions. It seems unlikely though, that it will be necessary to increase forest cover to 30% to achieve significant landscape benefits in most areas.

The use of property valuations as a way of eliciting WTP for forest cover was similarly inconclusive. Many respondents to the survey said that they thought the forest would affect property values, but only about half were prepared to estimate their WTP in this way. Of those that did, the results were quite promising in that they were correlated with the overall rankings given to photographs. Again however, it would probably be better to carry out further surveys before passing final judgment on this approach to valuation.

## 5.5 A COST-BENEFIT ANALYSIS OF THE THREE LEAD COMMUNITY FORESTS

Having collected all the data on WTP for the creation of the forests, it was decided to incorporate this into a simple cost-benefit analysis of the three lead forests, to see what the overall net present value of the forests might be and judge the desirability of redirecting forestry policy towards encouraging these sorts of developments. This involved estimating what the area of the forests was likely to be, what species were likely to be planted, how much this would cost, and what the total financial and non-financial benefits of creating the forests would be. It was done in conjunction with the project directors (who supplied information about the areas and species to be planted from their plans), and used other data sources to supply information about, for example, the cost of land, forestry costs and revenues, and the value of benefits other than those captured in the WTP survey.

Two simplifications were made in the cost-benefit analysis:

1. All costs and benefits were discounted using a six percent discount rate; and

2. all costs and benefits were initially discounted as though the whole of each forest would be planted in one year, then the net present value (NPV) of each forest was converted to an average per hectare figure which was then distributed over time according to the speed with which it was felt each forest would be planted, then discounted and aggregated a second time to take into account the effect of gradual implementation on NPV.

The first simplification was made because the public sector discount rate is currently 6%, and it would have been quite complicated to calculate the NPV from all its constituent costs and benefits at a range of different discount rates. The second simplification also made the calculations much easier and contained the implicit assumption that all the costs and benefits of the forest would be affected (in terms of their timing) in the same way by the gradual planting of the community forests. All costs and benefits were estimated in terms of their resource values rather than market prices, and where markets did not exist for inputs and outputs or were distorted in some way, this was taken into account in the analysis.

This final section discusses the main resource costs that were identified and quantified in the forests then discusses their main resource benefits. It finishes by drawing together these two sides of the analysis and reporting the NPV of the three lead forests, then compares this to earlier estimates of the NPV of community type forests. Greater detail about how these costs and benefits were calculated can be found in Whiteman and Sinclair (1994a).

<u>The cost of creating the forests</u>

The main costs of creating the forests were identified as being the cost of lost agricultural output from the land which would be planted with trees, plus the cost of resources that would go into establishing the forests. The latter included forestry establishment and maintenance costs, the cost of creating recreational infrastructure and the management or overhead costs of administering the projects.

Land costs

The existing pattern of land use in the three land forests is shown in Table 5.5.1 along with estimates of the areas of different types of land it was thought would be planted with trees. Most of the land in the three forests was good agricultural land (in grades 1-3), but it was felt that the forests would tend to be planted on the poorer agricultural land (grades 4-5) and on urban and non-agricultural land (urban land included roads and verges, buildings and industrial sites, parks and playing fields, and non-agricultural land encompassed derelict industrial and agricultural land, mineral workings and land not falling into any of the other categories). This reflected two of the objectives of the community forests which were to protect (ie not plant with trees) the best agricultural land and improve the appearance of urban and derelict/reclaimed land through tree planting.

Given these planting programmes, the first task was to estimate the resource cost of taking this land out of its current use and replacing it with trees. In the case of urban and non-agricultural land it was assumed that the resource value of this land was zero. For urban land this assumption was justified on the grounds that this land was mainly open space essentially left for amenity purposes and that the planting of trees would not preclude its use for these purposes (although strictly speaking, an estimate of the value of open space should perhaps have been estimated and included in the calculation to correctly measure the net amenity effect of planting trees). While some urban land may have potential development or "hope" value associated with it, it was felt that this was unlikely to be planted with trees anyway, such that the only urban land that would be planted

Table 5.5.1 Existing land use and proposed area to be planted with trees in the three lead community forests

Areas in hectares

| Land use category | Forest of Mercia | Thames Chase | Great North Forest |
|---|---|---|---|
| Current land use | | | |
| Agricultural land grade 1 | 0 | 492 | 0 |
| Agricultural land grade 2 | 2,121 | 985 | 480 |
| Agricultural land grade 3 | 7,371 | 3,940 | 9,280 |
| Agricultural land grade 4/5 | 5,124 | 1,182 | 800 |
| Non-agricultural land | 2,625 | 1,503 | 1,360 |
| Urban land | 2,415 | 788 | 2,720 |
| Existing woodland | 1,344 | 960 | 1,360 |
| Total | 21,000 | 9,850 | 16,000 |
| Land to be planted | | | |
| Agricultural land grade 1 | 0 | 0 | 0 |
| Agricultural land grade 2 | 0 | 0 | 120 |
| Agricultural land grade 3 | 848 | 800 | 2,640 |
| Agricultural land grade 4/5 | 1,725 | 150 | 280 |
| Non-agricultural land | 2,176 | 1,000 | 640 |
| Urban land | 907 | 50 | 0 |
| Total | 5,656 | 2,000 | 3,680 |
| Proposed woodland cover | 33.3% | 30.1% | 31.5% |

Table 5.5.2 Resource cost of agricultural land measured as a percentage of its market price (taken from a variety of studies)

| Land grade | Great North Forest agriculture study | | MAFF estimate | Treasury estimate | Harvey (1991) |
|---|---|---|---|---|---|
| | using net margins | using gross margins | | | |
| 1 | N/A | N/A | 38% | -ve | 47% |
| 2 | 0% | 67% | 38% | -ve | 47% |
| 3 | 0% | 82% | 68% | 55% | 47% |
| 4/5 | 0% | 42% | 70% | 63% | 47% |

with trees would be land where development was restricted by regulations such as planning laws. Derelict and reclaimed land generally has no productive use in its unimproved state and little amenity value so it was felt justified to attribute zero value to this land. Indeed it could be argued that in its unimproved state this land produces disbenefits or has a negative amenity value, so in the sensitivity analysis a notional benefit of £100/ha was attributed to taking non-agricultural land out of derelict state as a low cost scenario.

By far the largest task however, was to estimate the resource value of the agricultural land which would be planted with trees. The market price of agricultural land in each of the areas was obtained from Valuation Office reports (Valuation Office, 1991), but the market price of agricultural land is strongly distorted by agricultural subsidies such that it bears little resemblance to the resource value of the land. Two ways of estimating the resource value of land exist.

1. Calculating the profit from agricultural activities using world market (ie unsubsidised) prices and capitalising this to give the resource value; or

2. calculating the subsidies paid on different types of land then capitalising these and subtracting them from market prices to give the resource value;

and both of these approaches were used in the appraisal.

The resource value of land measured as a percentage of market price calculated in both these ways from a variety of studies is shown in

Table 5.5.2. A report on farm profitability in Great North Forest was used to estimate the resource value of land in the first way, by substituting world market prices for subsidised prices in the accounts presented in the report, and capitalising the resultant annual net and gross margins at 6% to give the figures shown in Table 5.5.2. Internal studies by the Treasury and MAFF were also obtained along with a report by Harvey (1991) which had gone down the other route of capitalising subsidies and subtracting them from market prices to give the other figures in the table.

It was noticeable that all of these different studies gave different estimates of the resource value of agricultural land, so in the final analysis an informed judgment had to be made about what figures should be put into the cost-benefit analysis. It was decided to use the average of these estimates in the central case scenario and higher/lower estimates based on these results as alternative high/low scenarios in the cost-benefit analysis, and the per hectare and total land cost figures obtained in this way are shown at Tables 5.5.3 and 5.5.4 respectively.

Forestry planting and maintenance costs

Project directors also supplied information about the species and block sizes of forests they were aiming for in their forest plans (see Table 5.5.5). This was combined with information about forestry planting and management costs from a variety of sources including the Timber Growers Association (TGA), studies of private-sector costs (Lorrain Smith, 1987 and 1989) and the Forestry Commission (Dewar, 1991) in order to calculate the total discounted cost of planting and

Table 5.5.3 Resource cost of agricultural land used in the cost-benefit analysis

In £/hectare

| Agricultural land grade and cost scenario | Forest of Mercia | Thames Chase | Great North Forest |
|---|---|---|---|
| Market price | | | |
| 2 | 8,200 | 8,200 | 6,000 |
| 3 | 6,300 | 6,300 | 4,200 |
| 4/5 | 3,900 | 3,900 | 2,200 |
| Low resource cost estimate | | | |
| 2 | 2,960 | 2,960 | 2,050 |
| 3 | 2,960 | 2,960 | 2,050 |
| 4/5 | 1,560 | 1,560 | 880 |
| Central resource cost estimate | | | |
| 2 | 3,690 | 3,690 | 2,560 |
| 3 | 3,690 | 3,690 | 2,560 |
| 4/5 | 2,340 | 2,340 | 1,430 |
| High resource cost estimate | | | |
| 2 | 4,980 | 4,980 | 3,900 |
| 3 | 4,980 | 4,980 | 3,360 |
| 4/5 | 2,730 | 2,730 | 1,540 |

Table 5.5.4 Total resource cost of land used in the cost-benefit analysis

In £ million

| | Forest of Mercia | Thames Chase | Great North Forest |
|---|---|---|---|
| Market price | 12.9 | 6.1 | 12.7 |
| Low resource cost | 5.0 | 2.5 | 5.8 |
| Central resource cost | 7.2 | 3.3 | 7.5 |
| High resource cost | 9.8 | 4.9 | 10.0 |

| Table 5.5.5 Proposed planting programme in the three lead community forests<br><br>Areas in hectares | | | |
|---|---|---|---|
| Species | Forest of Mercia | Thames Chase | Great North Forest |
| Oak | 975 | 885 | 860 |
| Ash | 725 | 615 | 250 |
| Poplar | 150 | 0 | 0 |
| Sycamore | 250 | 0 | 870 |
| Beech | 150 | 0 | 250 |
| Alder | 178 | 0 | 0 |
| Sweet chestnut | 0 | 265 | 0 |
| Scots pine | 178 | 235 | 600 |
| Corsican pine | 200 | 0 | 0 |
| Japanese larch | 475 | 0 | 600 |
| European larch | 375 | 0 | 0 |
| Norway spruce | 0 | 0 | 250 |
| Amenity planting | 2,000 | 0 | 0 |
| Total | 5,656 | 2,000 | 3,680 |

| Table 5.5.6 Estimates of planting costs taken from a variety of sources<br><br>in £/hectare | | | |
|---|---|---|---|
| Source and crop type | Establishment cost | Maintenance cost (yrs 1–25) | Maintenance cost (yrs 11+) |
| TGA | | | |
| Upland conifers | 1,433 | 32 | 27 |
| Lowland conifers | 2,538 | 50 | 25 |
| Broadleaves | 3,579 | 95 | 76 |
| Broadleaves in tubes | 4,917 | 95 | 107 |
| Mixed crops | 3,417 | 95 | 77 |
| Lorrain–Smith (1987) | | | |
| Conifers | 2,320 | 22 | 20 |
| Broadleaves | 4,965 | 39 | 22 |
| Broadleaves in tubes | 6,205 | 49 | 28 |
| Lorrain–Smith (1989) and Dewar (1991) | | | |
| Conifers | 1,005 | 24 | 24 |
| Broadleaves | 1,805 | 35 | 22 |
| Broadleaves in tubes | 3,655 | 35 | 22 |

managing the forests. The sources of these costs are shown in Table 5.5.6 (it was assumed that 40% of establishment costs would occur in the year of planting, 30% in the following year and 10% in each of the following three years). Again, the range of costs from these various sources was quite high, so it was assumed that costs nearer the higher end of the range would be typical and were used in the central case scenario while costs nearer the lower end of the range were used as a low cost scenario.

The use of quite high costs in the central case scenario was justified on the grounds that establishing woodlands close to urban areas is quite expensive due to greater pressures from the visiting public than would normally occur and the risk of vandalism. As a high cost scenario, it was assumed that all planting on urban land and 10% of the rest of the area may require additional replanting and re-fencing (which would add approximately 10% to costs in these areas) and 25% of the non-agricultural area would require an additional £300/ha to be spent on site amelioration (because of problems such as site compaction and nutrient deficiency on derelict land and reclaimed mineral workings). The total discounted cost of planting the forests calculated from the cost models and under these assumptions is shown in Table 5.5.7.

Recreation infrastructure and administration costs

In addition to planting trees, the forests will also require considerable investment in recreation and access facilities to cope with the anticipated number of visitors and realise their full potential for recreation. Project directors estimated what would be

Table 5.5.7 Total estimated planting cost used in the cost–benefit analysis

In £ million

| | Forest of Mercia | Thames Chase | Great North Forest |
|---|---|---|---|
| Low resource cost | 12.5 | 5.1 | 7.5 |
| Central resource cost | 30.2 | 11.1 | 19.4 |
| High resource cost | 31.1 | 11.3 | 19.6 |

Table 5.5.8 Total estimated cost of providing recreation infrastructure and administration in the three lead community forests

In £ million

| | Forest of Mercia | Thames Chase | Great North Forest |
|---|---|---|---|
| Recreation infrastructure | | | |
| Ranger services | 2.10 | 0.69 | 2.10 |
| Information points | 0.09 | 0.04 | 0.09 |
| Linear routes | 0.49 | 0.25 | 0.49 |
| Car parking | 0.72 | 0.35 | 0.72 |
| Total | 3.40 | 1.33 | 3.40 |
| Above total adjusted in line with growth in use | | | |
| Slow growth in use | 0.68 | 0.23 | 0.68 |
| Expected growth in use | 1.04 | 0.41 | 1.04 |
| Rapid growth in use | 1.30 | 0.51 | 1.30 |
| Project team costs | | | |
| Low cost scenario | 1.80 | 1.80 | 1.70 |
| Central & high cost scenario | 2.50 | 2.50 | 2.40 |
| Grant administration costs | | | |
| All three scenarios | 1.10 | 0.40 | 0.70 |
| Total estimated cost | | | |
| Low resource cost | 3.58 | 2.43 | 3.08 |
| Central resource cost | 4.64 | 3.31 | 4.14 |
| High resource cost | 4.90 | 3.41 | 4.40 |

required in terms of ranger services, information boards, trails/cycleways/ bridleways and car parking areas on the basis of current local authority and Forestry Commission provision in similar heavily used forests. Forestry Commission costs for the provision of these services and facilities were then obtained and costs were capitalised to give a total cost of provision for each forest. These costs were initially capitalised as though all the facilities would be put in in the year of planting but they were then split into discrete amounts which would be put in place as visitor numbers grew (see the next section on the assumed time profile of visitor numbers), and these amounts were recapitalised to take into account the gradual introduction of facilities (the sensitivity analysis depended on the rate of growth in visitor numbers). Project team budgets were also obtained and capitalised (it was assumed that the teams would diminish in size as the forests matured and the requirements for advice and planning diminished), to give an estimate of these costs. To these were added the cost of processing grant applications (obtained from Forestry Commission records) taking into account the number of applications it was estimated each forest would generate, to give a total estimated administration cost for each forest. Total estimated recreation infrastructure and administration costs calculated in this way are shown in Table 5.5.8.

Benefits of the forests

The benefits of community forests are likely to be many and varied. However, the current state of knowledge with respect to valuing the non-market benefits of forests is still quite limited. Chapter 3 discussed the valuation of timber and earlier parts of this chapter discussed the valuation of recreation and amenity benefits, and the value of these two outputs were fairly easily estimated and incorporated into the analysis. In addition to these, an estimate was also made of the non-timber income that might be achieved in the forests, The only other relevant non-market benefit where research has advanced to a reasonable extent is the value placed on forests as a sink for atmospheric carbon, so estimates of this were also incorporated into the analysis drawing on other research that has been done in this field.

Timber income

The planting programme shown in Table 5.5.5 was used in combination with the log-linear conifer price size curve described in Chapter 2 and the broadleaf price size curve described in Chapter 3 to calculate the discounted timber revenue that would be obtained in these forests. It was assumed that all the woodland planted, with the exception of the 2 000 ha to be planted for amenity purposes in Forest of Mercia, would be grown on a commercial basis resulting in the production of marketable timber at some time in the future. The model of long-run timber prices presented in Chapter 3 was also used to generate high and low sensitivity scenarios (of roughly +/- 11%), based on the 95% confidence limits obtained about the long-run path of future timber prices in that model. Total discounted timber income calculated in this way is shown in Table 5.5.9.

Non-timber income

It was also felt that the forests would be likely to generate significant amounts of non-timber income. They would be suitable for organised events (such as festivals and sporting occasions), would provide commercial recreation opportunities (eg camping, stalking and shooting); and may offer scope for franchising operations such as cycle hire, horse riding and selling refreshments, all of which would generate non-timber income. Sales of other permits and car parking charges might also be considerable sources of income.

In an attempt to estimate what level of non-timber income might be achieved in the forests, Forestry Commission accounts were examined to see what levels of non-timber income are obtained in similar forests where the sale of these sorts of goods and services is well developed. Net non-timber income is about £2.5 million per annum in New Forest and similar levels of income are achieved in other popular forests such as Forest of Dean, Delamere and Thetford (after taking into account differences in visitor numbers). It was therefore judged that £1 million per annum would be a reasonable estimate of non-timber income in these forests taking into account their size and location. This again, was assumed to start off at a low level then build up gradually to this level as the forests matured and visitor numbers increased.

In addition to the sale of non-timber goods and services, project directors also indicated that there was some interest in sponsorship of the forests amongst local businesses and community groups. This was more difficult to estimate so it was assumed that £20,000/yr might be obtained in Great North Forest and Forest of Mercia and £30,000/yr in Thames Chase for the first 15 years of the project (the high and low sensitivity scenarios assumed this would continue for 20 and 10 years respectively). These targets have already been achieved in most years

Table 5.5.9 Total estimated discounted revenues from timber production

In £ million

| | Forest of Mercia | Thames Chase | Great North Forest |
|---|---|---|---|
| Low resource benefit | 2.0 | 0.6 | 2.4 |
| Central resource benefit | 2.4 | 0.7 | 2.8 |
| High resource benefit | 2.7 | 0.8 | 3.1 |

Table 5.5.10 Total estimated non-timber income in the forests

In £ million

| | Forest of Mercia | Thames Chase | Great North Forest |
|---|---|---|---|
| Sale of goods and services | | | |
| Slow growth in use | 3.9 | 3.9 | 3.9 |
| Expected growth in use | 4.9 | 4.9 | 4.9 |
| Rapid growth in use | 5.8 | 5.8 | 5.8 |
| Sponsorship | | | |
| Low estimate | 0.3 | 0.4 | 0.2 |
| Central estimate | 0.3 | 0.5 | 0.3 |
| High estimate | 0.4 | 0.6 | 0.3 |
| Total | | | |
| Low resource benefit | 4.2 | 4.3 | 4.1 |
| Central resource benefit | 5.2 | 5.4 | 5.2 |
| High resource benefit | 6.2 | 6.4 | 6.1 |

Table 5.5.11 Total estimated value of carbon storage in the forests

In £ million

| | Forest of Mercia | Thames Chase | Great North Forest |
|---|---|---|---|
| Low resource benefit | 0.0 | 0.0 | 0.0 |
| Central resource benefit | 1.7 | 0.8 | 1.6 |
| High resource benefit | 2.6 | 1.2 | 2.5 |

Table 5.5.12 Total estimated recreation and amenity benefits in the forests

In £ million

| | Forest of Mercia | Thames Chase | Great North Forest |
|---|---|---|---|
| Slow growth in use | 28.0 | 22.6 | 17.2 |
| Expected growth in use | 58.8 | 47.8 | 36.7 |
| Rapid growth in use | 125.6 | 102.7 | 79.2 |

so far. Non-timber income and sponsorship income was then capitalised to give the figures in Table 5.5.10.

Local and global atmospheric benefits

There is currently increasing concern about atmospheric pollution leading to phenomena such as global warning and acid rain. Countries are now looking at ways of reducing harmful emissions or ameliorating their effects and tree planting is seen as one way in which the impact of atmospheric pollution can be reduced. On a local scale, trees can help by filtering pollutants out of the atmosphere due to their large surface area, and they can also help indirectly by providing shelter and thus reducing energy consumption. It was not however, possible to value these effects in the cost-benefit analysis. The main global effect they can have is as a sink for carbon which, in the form of carbon dioxide, is a major greenhouse gas, and several estimates of the cost of carbon dioxide emissions have been produced (see Price and Willis, 1993, for a quite wide review of such studies).

As trees grow they absorb carbon dioxide which is then stored as woody biomass until they are felled, when it is released back into the atmosphere over a period of time depending on what the wood is used for. It is currently estimated that forests in Britain store about 90 m tonnes of carbon, equivalent to about 6 months of British emissions (Thompson and Matthews, 1990). The carbon stored in forest products is released at various rates depending on how quickly products decompose. It is difficult to estimate exactly how much carbon is stored in forest products, but it is thought that this is likely to be at least double the estimate of that stored in forests.

Most studies have estimated the cost of increased carbon dioxide in the atmosphere, so the benefit of storing carbon in trees is the converse of this (ie an averted cost). To place a value on the benefit of carbon storage in the community forests reference was made to three recent studies by Nordhaus (1990), Walters and Ayres (1990) and Anderson (1991). These gave a quite wide range of valuations which, when converted from valuations measured in units of carbon stored to valuations measured in cubic metres of timber indicated that the benefit of storing carbon in trees could range from a negligible amount to £6/$m^3$ with a central value of about £4/$m^3$. (It must be noted however, that some of these studies included discounted cash-flow calculations using a discount rate other than 6%, so their results are not entirely consistent with the framework for analysis presented here.)

The planting programme for each of the forests was used to estimate the net annual change in the standing volume of biomass in the forests in each year (taking into account both growth and fellings), and this was valued (at £0/$m^3$, £4/$m^3$ and £6/$m^3$ in the low, central and high benefit scenarios respectively) as a benefit in years when growth exceeded fellings and a cost in years when the reverse was true. The profile of costs and benefits calculated in this way was then discounted and capitalised to give the total discounted benefit of carbon storage over one rotation in each of the forests (shown in Table 5.5.11).

No account was taken of the benefit of carbon stored in forest products (ie it was assumed that carbon would be released immediately back into the atmospheric after felling), and it was assumed that there would be no release of soil carbon after planting the trees (this can be a problem, but is so generally only on peaty soils). Also ignored were emissions of carbon dioxide in the course of forest operations, because these have been shown to be generally very small (Whiteman, 1991b). It was felt that the net effect of leaving out these other factors would be negligible. A further simplification was that, by using a value per $m^3$ for carbon storage, the quantity of carbon stored in each $m^3$ would be the same. The figures used were based on storage in conifers so, in as much as broadleaves store slightly more carbon than conifers, the figures were probably small underestimates.

Recreation and amenity benefits

It was suspected that the largest non-financial benefit of planting the community forests would be the value of the landscape improvement and recreation opportunities they would provide, as measured by residents' WTP for their creation. An earlier section of this chapter described in detail how estimates of WTP were collected, based on photographs and descriptions of what the community forests would look like. Converted to an annual value, WTP ranged from £7.50-9.50 per person per year, and variability, as measured by the standard error of the estimate, was £1.00-1.35. However, these results were based on information presented to respondent about what the forests would finally look like. It will take some time for the forests to reach the levels of maturity and attractiveness presented to respondents so, to take into account the time lag between planting the community forests and their becoming a valuable landscape and recreational asset, assumptions were made about the rate at which the forests would start to look attractive and attract visitors.

There is no evidence to support any particular rate of growth in attractiveness or visitor numbers with forest age, but it seemed reasonable to expect that recreation would be low in forests under 15 years old and their appearance would not match that shown in the photographs until they were at least 30 years old. Three Gompertz curves were therefore constructed to represent low, central, and high rates of growth in visitor numbers and attractiveness at different forest ages, and were used to scale the stated annual WTP for the forests over time. These time profiles assumed for WTP at different crop ages and used in the cost-benefit analysis are shown in Figure 5.5.1. The standard error of the stated WTP was also used to give 95% confidence limits for WTP such that the low scenario for recreation and amenity benefits was estimated to be two standard errors below the mean and the high scenario two above it.

Combining costs and benefits

Table 5.5.13 summarises all the estimated resource costs and benefits associated with planting the three lead community forests. It can be seen that land, planting and management costs account for most of the costs of the forests, and recreation and amenity benefits account for most of the benefits. In strictly financial terms, the forests have a negative NPV of £4,000-7,500/ha but, after taking into account non-financial benefits, their NPV is positive in all cases. This is also true under the high and low cost and benefit scenarios and only under the very pessimistic scenario of low benefits and central or high costs would two of the forests have a negative NPV (Thames Chase has a positive NPV under all the possible combinations of high/central/low costs and benefits). Taking into account that it will take 40-50 years to plant the forests, their NPVs are reduced by about two-thirds.

**Figure 5.5.1 Gompertz curves used to scale annual willingness to pay for the creation of the community forests with forest age**

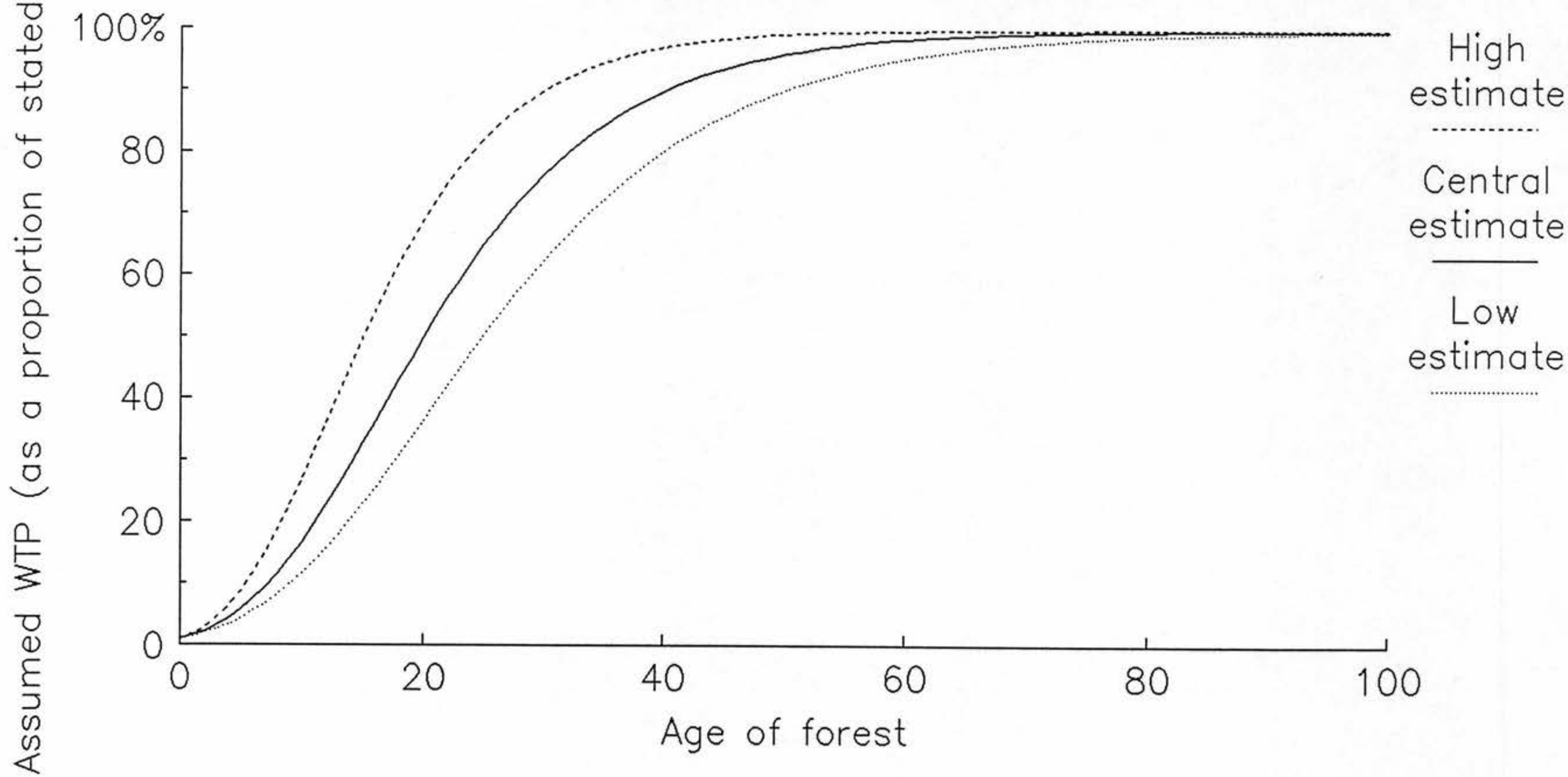


Table 5.5.13 Summary of discounted resource costs and benefits associated with planting the three lead community forests

All figures in £ million except NPV/ha which is in £/ha

| Iten of cost/benefit | Forest of Mercia | | | Thames Chase | | | Great North Forest | | | Type of cost/benefit |
|---|---|---|---|---|---|---|---|---|---|---|
| | Low | Central | High | Low | Central | High | Low | Central | High | |
| Costs | | | | | | | | | | |
| Land | 12.9 | 12.9 | 12.9 | 6.1 | 6.1 | 6.1 | 12.7 | 12.7 | 12.7 | Financial |
| Adjustment to land cost | -7.9 | -5.7 | -3.1 | -3.6 | -2.8 | -1.2 | -6.9 | -5.2 | -2.7 | Non-financial |
| Planting and management | 12.5 | 30.2 | 31.1 | 5.1 | 11.1 | 11.3 | 7.5 | 19.4 | 19.6 | Financial |
| Recreation infrastructure | 0.7 | 1.0 | 1.3 | 0.2 | 0.4 | 0.5 | 0.7 | 1.0 | 1.3 | Financial |
| Project team | 1.8 | 2.5 | 2.5 | 1.8 | 2.5 | 2.5 | 1.7 | 2.4 | 2.4 | Financial |
| Grant administration | 1.1 | 1.1 | 1.1 | 0.4 | 0.4 | 0.4 | 0.7 | 0.7 | 0.7 | Financial |
| Total | 21.1 | 42.0 | 45.8 | 10.0 | 17.7 | 19.6 | 16.4 | 31.0 | 34.0 | |
| Benefits | | | | | | | | | | |
| Timber production | 2.0 | 2.4 | 2.7 | 0.6 | 0.7 | 0.8 | 2.4 | 2.8 | 3.1 | Financial |
| Sale of goods and services | 3.9 | 4.9 | 5.8 | 3.9 | 4.9 | 5.8 | 3.9 | 4.9 | 5.8 | Financial |
| Sponsorship | 0.3 | 0.3 | 0.4 | 0.4 | 0.5 | 0.6 | 0.2 | 0.3 | 0.3 | Financial |
| Carbon storage | 0.0 | 1.7 | 2.6 | 0.0 | 0.8 | 1.2 | 0.0 | 1.6 | 2.5 | Non-financial |
| Recreation and amenity | 28.0 | 58.8 | 125.6 | 22.6 | 47.8 | 102.7 | 17.2 | 36.7 | 79.2 | Non-financial |
| Total | 34.2 | 68.1 | 137.1 | 27.5 | 54.7 | 111.1 | 23.7 | 46.3 | 90.9 | |
| Financial NPV | -22.8 | -40.1 | -40.0 | -8.7 | -14.4 | -13.6 | -16.8 | -28.2 | -27.5 | |
| Resource NPV | 13.1 | 26.1 | 91.3 | 17.5 | 37.0 | 91.5 | 7.3 | 15.3 | 56.9 | |
| Financial NPV/ha | -4028 | -7097 | -7072 | -4365 | -7205 | -6805 | -4560 | -7674 | -7473 | |
| Resource NPV/ha | 2320 | 4607 | 16142 | 8735 | 18495 | 45745 | 1989 | 4147 | 15462 | |
| Resource NPV accounting for gradual implementation | 4.3 | 8.6 | 30.0 | 5.7 | 12.1 | 30.0 | 2.4 | 5.0 | 18.7 | |

The fact that the financial NPV is negative but the resource NPV is positive suggests that incentives for planting these forests are justified. However, a separate analysis of the grants available for planting these forests showed that these would only cover about half of the financial costs of planting them under the central and high cost scenarios. Under the low cost scenario, grants would just about cover total financial costs. This would mean that, under current incentive regimes, it may be difficult to achieve the level of planting aimed for in these areas (although as the previous section showed, this might not be a problem if the target of 30% forest cover is higher than necessary). It certainly points to a need to evaluate these projects as they develop, to review their objectives and achievements and re-examine the figures used in this cost-benefit analysis.

Comparing these results to earlier estimates of the value of community forests (such as that given in Table 2.4.1), the NPV/ha of these forests is much higher than previous estimates. This is mainly because the recreation and amenity benefits reported earlier in this chapter result in estimated benefits (even allowing for a gradual build-up to the stated benefit as the crop matures) that are 5, 10 or 20 times greater than was previously thought possible. This is largely because the location of these forests is so close to centres of population, that a large number of people are likely to be affected by them. For example, in the calculation of recreation value in Table 2.4.1, high visitation was estimated to be 500 visits/ha/year whereas even the recreation model estimated in Chapter 4 predicts visitor numbers to these forests four times this amount and, if stated use of the forest is to be believed, residents said that they would use the forests to an extent equal to well over 5,000 visits/ha/yr. These results certainly seem to indicate that community forests could be very heavily used in the future.

## Conclusions

This section has attempted to draw together the results reported in earlier sections of this chapter and, with the aid of other information, present a fairly simple cost-benefit analysis of the three lead community forests. This analysis has shown that the three forests are likely to have a highly positive NPV largely on the strength of the value of recreation and amenity benefits they will provide for local residents. On the basis of these results, it would seem likely that an expansion of woodland close to major towns and cities all over Britain would be beneficial depending on the proposed area to be planted and the number of people that will be affected by them.

This analysis however has had to use assumptions about the timing of some of these benefits (notably the recreation and amenity benefit). It has also had to assume that there is no displaced or transferred recreation and amenity benefit associated with the creation of these forests (for example, it has assumed that the land planted with trees had no amenity or recreational benefit before the trees were planted). This latter assumption may be justified because much of the proposed land to be planted is either derelict or agricultural land (where recreation is not generally encouraged), and one of the aims of the forests is to provide recreational facilities close at hand to people who could not otherwise afford to make visits to the more distant countryside. The first assumption does though, suggest that more research could be done into the timing of forestry recreation and amenity benefits; a point which will be picked up in the next chapter.

# CHAPTER 6

# IMPLICATIONS OF THE RESEARCH

## 6.1 POLICY IMPLICATIONS

Chapter 1 described the three main aims of this research as being to investigate the factors affecting the supply and demand for certain forestry outputs, to produce forecasts of those outputs, and to investigate the implications of these results for current and future policymaking. This section covers the last of these aims (the final section will discuss further research that might also be useful in these areas).

It starts by re-stating the policy objectives which can be examined in the light of this research, then goes on to discuss the achievements of forestry policy in these areas to date. The discussion highlights potential problems that might arise in the future, and is followed by a discussion of possible solutions to these problems. Of particular interest to forestry policymakers is the role for new planting in meeting forestry policy objectives, and this is discussed at the end of the section.

### Achievements of forestry policy to date

Table 1.2.1 set out the main objectives of current forestry policy. Many of these relate to environmental aspects of forestry and as such, cannot be linked to the results of this research in a major way. However, several of the general objectives (eg to increase the quality and quantity of woodland recreation, increase the potential for timber production, and develop markets for forest products), and some of the objectives related to the expansion of woodland (eg to promote the expansion of woodland into appropriate areas, and to promote the expansion of woodland for multiple benefits), can be viewed in the light of this research. Stated in very general terms, the implications of the timber supply and demand modelling for the development of the wood processing industry should be examined, as should the implications of the forest recreation and community forest research for the objectives related to the use of woodland for recreation and multiple uses generally. Also relevant is the question of the relative priority that should be attached to these objectives in light of their current and future importance in economic terms.

Taking the wood-processing industry or timber market objectives first, Chapter 2 showed that the way these have been promoted by forestry policy in the past has been by entering into supply contracts with large wood users, producing forecasts of future supply, and by encouraging forestry expansion. Supply contracts have been justified on the grounds that the domestic industry requires a stable source of supply which, without these contracts, would not be forthcoming from the private sector or a Forestry Commission acting in a more commercial way. Chapter 3 investigated the short-run elasticity of timber supply (with respect to price) and found there are quite wide fluctuations in timber prices from year to year and that the private sector does alter timber production in response to such price changes with an elasticity of about 0.4-0.5. The Forestry Commission on the other hand, does not appear to have altered production in any major way in response to price changes.

This research has not investigated whether it is really necessary to have stable sources of supply for the development of the domestic wood-processing industry but, if this is taken at face value to be true, these results would seem to imply that there is a small degree of uncertainty about timber supply in the short-run which might concern the industry. The time-series model of timber prices for example, gave 95% confidence limits of ± 30% about the long-run average timber price which, combined with an elasticity of supply of say 0.45, would imply that supply could vary by up to ± 13% in any year. Given that half of the UK's timber supply is controlled by the Forestry Commission, these results have shown that the contractual and harvesting policies followed by the Forestry Commission have reduced this uncertainty by about half and that at most, short-run supply uncertainty is likely to amount to no more than 0.5 million $m^3$ in the future (out of a total supply figure which is set to peak at about 17 million $m^3$), if these policies are continued.

Chapter 3 also investigated the robustness of the supply forecast with respect to a range of other uncertainties such as optimal rotation ages, improvements in yield, and changes in forest management practices which might result from attempts to meet other environmental objectives of forestry policy in the future. Most of the research concentrated on the economic aspects of the supply forecast such as the effect changes in the price-size relationship or trends in long-run timber prices would have on optimal rotation ages. It found that the supply forecast was not significantly affected by uncertainty about the economic factors underlying it (most of these changed the shape of the supply forecast only slightly), but that the effect of silvicultural improvements and changes in management practices could be quite large.

This therefore implies that the forecast is quite robust with respect to a range of plausible economic uncertainties about the future, and that these other factors (which may give rise to much larger changes in future supply) should be investigated more thoroughly.

Ultimately, the most significant way in which forestry policy has increased the potential for timber production is by its promotion of forestry expansion. This has been done directly by the Forestry Commission buying and planting bare land, and indirectly by grants (and until recently generous tax concessions) to private landowners. Chapter 3 showed that the area of conifers has increased from about 0.5 million ha in 1950 to 1.5 million ha in 1990 while the area of broadleaves has remained relatively unchanged over the period at about 0.5 million ha. Taking into account the fact that not all of this woodland is managed for timber production, a rough estimate of the sustainable level of timber supply that could be achieved from this woodland is about 13 million $m^3$/yr of softwoods and 1 million $m^3$/yr of hardwoods.

This rapid expansion of the area of woodland however, has also left the UK with a very unbalanced age structure within the forest estate. This is likely to give rise to a series of peaks and troughs in future timber supply, the first of which will occur in about 30 years' time. These may diminish over time but, inasmuch as they will make it difficult to persuade the wood processing industry that timber supplies will not diminish in the future, they may hamper future timber market development. These peaks and troughs could be reduced by a range of measures which will be discussed later. However, the implications of this research are that while the policy has been successful in increasing the potential for timber production by well over 100%, it has also created a potential problem for the future development of the wood-processing industry due to the predicted unevenness in future timber supply.

Chapter 4 investigated the supply of and demand for forests for outdoor recreation. The results displayed considerable variability partly due to differences in survey design, but indicated that, in very general terms, somewhere between 150-250 million visits are made to forests each year on trips over 3 hours long and 250-300 million visits made each year on trips of any duration. A conservative estimate was also made that 50 million of these visits are made to Forestry Commission woodlands. Although the survey technique used (household surveys rather than site surveys) made it highly likely that these results would capture types of visits not recorded in earlier surveys, this figure is far higher than any that has previously been obtained in surveys of visits to Forestry Commission woodlands. It does therefore seem to indicate that forest recreation has increased considerably over the last 20 years, implying that forestry policy has been successful in increasing the quantity of forest recreation.

Analysis of the activities pursued on visits indicated that most visitors undertook activities such as walking, watching nature and picnicking, that were in line with early statements on recreation policy in forests (that "quiet and contemplative use of the forest" should be encouraged). However, it could not be determined whether this reflected the demand for different activities or the supply of facilities. Analysis of travel distances showed that visitors wanting to watch or play sport for example generally had to travel further than other visitors to undertake these activities. The implications of this for policy are that for the majority of visitors access and fairly simple provision of facilities such as carparks and forest walks or trails is probably adequate, but that the demand for facilities for more specialised pursuits should be investigated further.

Examination of the socio-economic characteristics of forest visitors indicated that they tended to be young (under 55), often with children and quite wealthy. Individuals in social classes A, B and C1 were found in significantly greater numbers in the samples of forest visitors than in the population as a whole, as were individuals in work, owning their own homes, a car and a telephone. This has the interesting implication that policies to encourage forest recreation in the past have had a redistributive effect, having been paid for out of general taxation but having benefited those generally better off in society. This pattern of demand may reflect differences in tastes within society but, inasmuch as it may also reflect the inability of those less well off to afford to make visits to forests (the average travel cost alone of a forest visit was estimated to be between £3-5), it would suggest that more should be done to encourage recreation in forests close to where people live.

This implication was reinforced by the data collected on the supply of woodland for recreation. By far the largest provider of woodland with recreation facilities of one sort or another was the Forestry Commission (about 60% of its estate in England and 25% in Scotland and Wales, by area, contained facilities) followed by local authorities and the National Trust. However, with the exception of local authorities, much of this was found to be located in relatively remote rural areas.

With the exception of Greater London, the metropolitan counties had fairly low levels of recreational woodland cover as did some of the more densely populated rural counties (such as West Yorkshire, Humberside, Lancashire, Cheshire, Kent and Essex).

Having shown that forestry policy has increased woodland recreation but failed to some extent to increase the opportunities for recreation in the areas where demand is likely to be highest, Chapter 5 examined the costs and benefits associated with creating woodland very close to large urban centres. The Community Forest Initiative is still at an early stage of development so its effectiveness cannot be judged yet. However, *a priori*, the cost benefit analysis presented in Chapter 5 showed that the net benefits of the types and locations of woodland proposed in the initiative are likely to be quite large, and that the numbers of visits that might be made to such woods are substantial. The only major questionmark over the proposed forests this research highlighted was the appropriate level of forest cover that should be aimed for in the forests, which should be investigated further.

It is quite difficult to assess the relative priority which should be given to the different objectives of forestry policy because outputs from each of the objectives are measured in different units. One way in which this can be attempted, however, is by trying to value the different outputs for comparison. So, for example, Forestry Commission, timber income is currently about £83 million per year and, assuming the non-market benefit of a visit to a Forestry Commission woodland is about £1, the value of recreation in Forestry Commission woodlands is not far behind at about £50 million per year. Priorities will, of course, vary between woodlands with, for example, New Forest being much more important for recreation (about 11 million visitors per year) than timber production (about 40 000 $m^3$ of timber is harvested there each year), while the reverse is true for most forests in Scotland and Wales; so these priorities should be reflected in the way that forests are managed. In very broad terms, however, it would seem that the value of forest recreation could be at least £150 million/year (150 million visits x £1/visit) which is slightly larger than the value of timber production - £140 million/year, and that the redirection of forestry policy towards including benefits other than timber production has been a sensible change in direction.

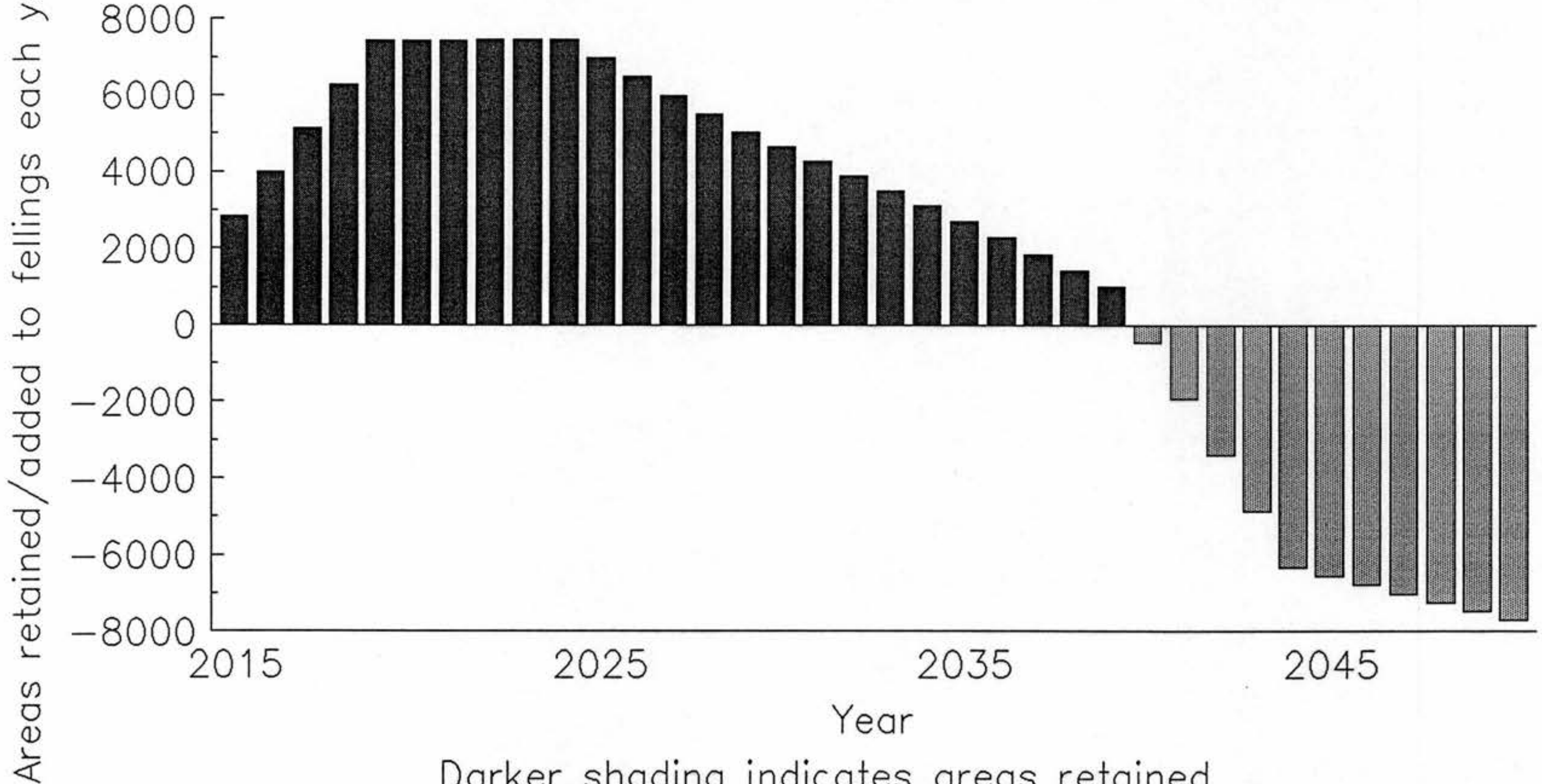
Future policy towards management of the forest estate

The discussion of current policy achievements above mentioned issues which it might be appropriate to address in future forestry policy. The two major issues listed were the forecast peak in timber production and the current mismatch in location between areas of woodland with recreation provision and centres of population (from which most demand is likely to emanate). Negative aspects of these issues could be alleviated by policies to adjust management of the current forest estate, policies to direct future forest expansion, or a mixture of both sorts of policy. Policies to adjust management of the current estate will be discussed below before the rest of this section discusses how forestry expansion might be directed in the future to address these issues.

Figure 3.4.1 showed how timber production is predicted to peak at about 17 million $m^3$ in 2020-2025. If forestry policymakers wished to smooth this peak to provide the domestic wood-processing industry with a sustained level of supply in the future from current forest areas, this would involve delaying some felling over the period 2015-2040 to provide additional forest resources to increase supply from 2040 onwards. Figure 6.1.1 shows the approximate area of woodland that would have to be retained to do this. Each hectare of woodland retained in this way would have to be felled about 20-25 years after the age currently planned in the supply forecast (or alternatively, a larger area of woodland could be retained for a shorter time). The cost of this would be approximately £4,500/ha at the planned felling age and using a 6% discount rate, and the cost of the total programme would be about £95 million discounted back to 1994/95.

Forestry policymakers, if they wished, would have four options open to them to achieve such an adjustment. They could do nothing, and leave the market to solve the problem. If the peak really was a problem for the wood processing industry, then supply would exceed demand during the peak in supply and lead to exports of roundwood, depressed timber prices or both during this period, which might have the same effect as a deliberate policy to delay felling of some areas. If it was not such a problem for the industry then the industry would be likely to expand and contract in line with changes in wood supply (which would be counter to current forestry policy but not necessarily undesirable). Two other options would be to alter the harvesting programme of the Forestry Commission and/or to encourage the private sector to do the same. All of these options would be likely to incur similar costs to those outlined above (although they would differ in terms of who would have to foot the bill). The fourth option would be to continue to encourage new planting of woodland for timber production.

Figure 6.1.1 Area of woodland that would have to be retained then cut later to provide additional areas to smooth the path of future timber supply




Darker shading indicates areas retained and lighter shading additional areas cut

It is likely of course that supply will adjust to demand and that both expansion and restructuring of felling will be used to smooth future timber supplies. Adjustments to the future pattern of timber harvesting are likely to give rise to environmental benefits as well as benefits to the wood processing industry, and the effect of forest design plans introduced for the Forestry Commission estate can already be seen to have smoothed the forecast peak in production, if the current supply forecast is compared to that produced previously (in Whiteman, 1991a). The decision which will have to be taken in the future therefore, is how much of this adjustment (if necessary) will be planned by policymakers (using their control over Forestry Commission harvesting policies and incentives to private woodland owners), and how much will be left to the market to decide.

Because of the current location of all types of woodland (both with and without recreation facilities) it is likely that, in many cases, the only way of increasing the area of woodland with recreational facilities near densely populated areas will be to plant new woodland specifically for this purpose. However, bearing in mind the length of time it takes for woodland to mature and become more interesting for visitors, forestry policy should also attempt to increase access to what little existing woodland there is around these areas. This will probably be done most easily by increasing access to Forestry Commission woodland (and in the recently completed Forestry Review, the Forestry Commission has been given permission to spend £0.9 million per year to do just this).

To see where priorities for increasing access to the existing Forestry Commission estate might lie, the counties of England and Wales were stratified by size, existing levels of recreational woodland provision (in terms of distance-weighted hectares per capita) were estimated, and the potential for increasing the area of woodland with recreation facilities within the existing area of the Forestry Commission estate were calculated; and the results by county are shown in Table 6.1.1. This table takes no account of the physical attractiveness of these woodlands (eg their species and age composition) nor the ease with which access could be facilitated. It only shows the current level of woodland equipped for recreation and the potential for increasing it, to present a guide to where access might be increased.

Of the large counties, only the residents of Hampshire currently enjoy a high level of recreational woodland per capita, with little scope for increase. The residents of Greater London and West Yorkshire are slightly worse off but again most Forestry Commission woodland within and around these counties is already supplied with recreation facilities so there is little scope for opening up new areas. There is slightly more scope for increasing access to Forestry Commission woodlands close to the West Midlands and South Yorkshire, where currently only between 30-50% (by area) have facilities of one sort or another. This would probably have to be done though, by opening up more woodlands in neighbouring counties rather than these counties themselves. However, the greatest priority should be to increase access to Forestry Commission woodlands around Merseyside, Greater Manchester, Lancashire and Essex.

The placement of smaller counties in the table can be interpreted in the same way. They show that the top priority for increasing access should be given to counties in the north-west (Cheshire and

| Table 6.1.1 Potential for increasing recreation provision on the exisiting Forestry Commission estate | | | | |
|---|---|---|---|---|
| County size | Level of existing provision | Potential for increase | | |
| | | low (under 100%) | medium (100% to 200%) | high (over 200%) |
| Large counties (population over 1 million) | Low | Kent | Greater Manchester<br>Lancashire<br>Essex | Merseyside |
| | Medium | West Yorkshire<br>Greater London | West Midlands<br>South Yorkshire | |
| | High | Hampshire | | |
| Medium-sized counties (population 500,000 to 1 million) | Low | Humberside | Derbyshire<br>Devon<br>Leicestershire<br>Hertfordshire | Cheshire<br>Staffordshire<br>Norfolk |
| | Medium | Berkshire<br>Surrey<br>East Sussex<br>West Sussuex | Hereford & Worcester<br>Nottinghamshire | |
| | High | Avon<br>Dorset | Tyne & Wear | |
| Small counties (population under 500,000) | Low | | Cambridgeshire<br>Bedfordshire<br>Northamptonshire<br>Warwickshire<br>Suffolk<br>Lincolnshire | Cornwall |
| | Medium | North Yorkshire<br>Buckinghamshire<br>Oxfordshire | | Clwyd<br>Shropshire |
| | High | Gloucestershire<br>Somerset<br>Wiltshire<br>Isle of Wight | Dyfed<br>Cumbria<br>West Glamorgan<br>Northumberland<br>Mid Glamorgan<br>Durham<br>Gwent<br>South Glamorgan<br>Cleveland | Gwynedd<br>Powys |

Note: Level of existing provision defined as low if the distance-weighted area of woodland per 1000 head of population is 1 or less, medium if it is between 1 and 2 or high if it is over 2.

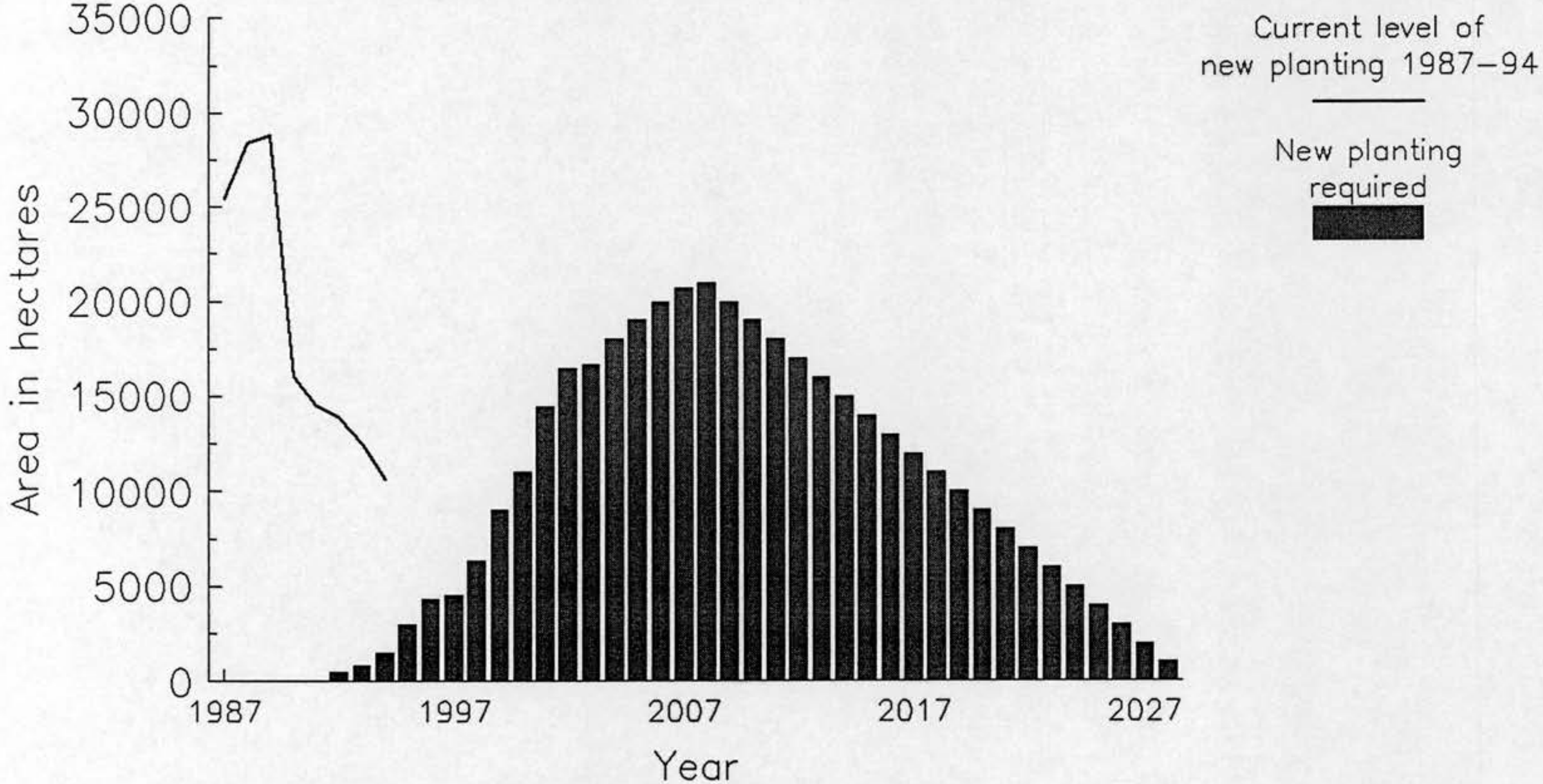
Staffordshire), south-west (Devon and Cornwall), and one or two other locations. The table also shows that increasing access to Forestry Commission woodlands within and around Kent and Humberside would be desirable, but that opportunities to do so are likely to be limited.

A similar table could be produced for private woodland to assess where priorities might lie in trying to encourage private landowners to encourage recreation in their woods. This would show some scope for increased access in and around several counties where provision is currently very low, including Kent, South Yorkshire, Devon, Hertfordshire and Norfolk. However, other management objectives might dissuade owners from allowing the public to enter these woods in many cases.

Directions for forestry expansion

Both of the issues discussed above could also be addressed by well designed policies for forestry expansion. To smooth the forecast peak in production for example, would require new planting of conifers on the scale shown in Figure 6.1.2. Something similar to this level of planting is likely to be achieved with current incentives for forestry and, if so, this would increase the level of timber supply to about 18.5 million $m^3$ by 2050. The total discounted exchequer cost of such a level of planting (at current grant rates) would be £108 million (discounted to 1994/95) however, making it slightly more expensive than the cost of restructuring felling to smooth the peak in supply, although the new sustained level of production would be higher than under the restructuring option.

Figure 6 . 1 . 2 Annual new planting of conifers required to smooth the future path of timber supply at a level of about 18 . 5 million m3

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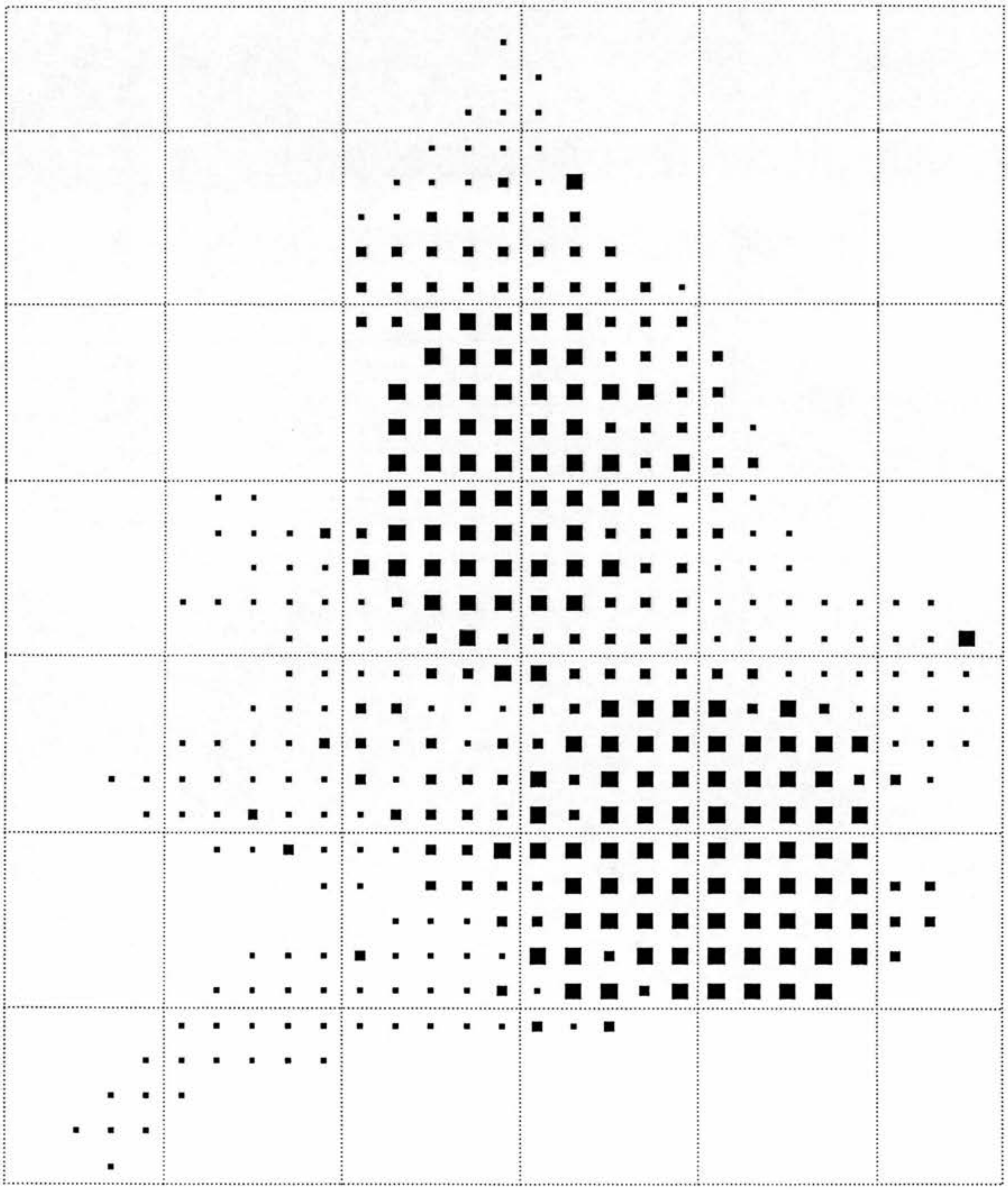
The resource cost or benefit of any new planting programme though would very much depend on the level of non-market benefit that could be attributed to such planting, part of which would include the level of recreation benefits enjoyed by forest visitors. This would depend on a range of factors such as the type of woodland planted and accessibility, but one important factor would be the location of any new woodland with respect to centres of population. The recreation model developed in Chapter 4 could be used to indicate where visitor numbers might be highest and as such, give guidance as to where new planting should be encouraged.

Assuming that the opportunity cost of land is about half its market price (see Chapter 5), the average NPV (at 6%) of a mixed woodland that might be suitable for forest recreation would be about -£2,000/ha. Assuming also that visitor numbers would build-up over the rotation in the way described in Chapter 5, and that the value of recreation might be about £1/visit, this would imply that the mature forest would have to attract about 320 visitors/ha for the non-market benefit of recreation to equal this financial cost (ie negative NPV) of planting the forest.

Figure 6.1.3 shows for a sample of points (at 20 km intervals) across England and Wales the number of visitors (per hectare) that might be expected to visit woodland planted at these locations. These results show that new planting of woodland could be justified on the grounds of the recreation benefits alone that they would supply, across 70% of England and 20% of Wales. This would depend of course, on visitors being allowed access to such woodland, and these figures are only a broad-brush estimate of where new planting would be beneficial. They

## Figure 6.1.3 Number of visitors to newly planted woodland predicted using the recreation model developed in Chapter 4



The size of squares indicate the predicted number of visits that would be made per hectare (under 300; 300–600; and over 600) show however, where initiatives such as community forests should be encouraged and demonstrate one use that could be made of the recreation model described in Chapter 4.

Conclusions

This section has discussed the achievements of forestry policy to date in the areas of timber production and forest recreation. It has shown that while policy has been successful in increasing timber supply ad (probably) the number of visits made to forests, it has led to an unbalanced expansion of forestry in the past which has created a potentially awkward peak in future timber production, and failed to promote forests in areas where recreation could be very great. It has then gone on to discuss how changes in management of the estate and forestry expansion could address these issues to give direction to future forestry policy. With current levels of new planting and initiatives such as the Community Forest Initiative it seems likely that future policy will be successful in continuing to increase timber production and the quantity of forest recreation if attention is paid to the wider benefits of forestry as the most recent statement on forestry policy claims it will.

## 6.2 FURTHER RESEARCH

The research that is reported in earlier chapters of this thesis has attempted to assemble a coherent picture of some of the main factors underlying the supply and demand for forestry outputs. It has in places, however, had to rely on relatively poor data source, use assumptions, and has had to present results that are subject to some uncertainty. To assist anyone thinking of carrying out further research in these areas therefore, this short final section outlines areas of research that might be most beneficial in the future.

### Timber prices, supply, and demand

Research into the price-size relationship would be improved by better data on domestic timber prices. The data produced regularly by the Forestry Commission on standing timber prices is good, but very little data is produced on sawlog and pulpwood prices and none on non-coniferous roundwood prices (the CSO index referred to in Chapter 3 has recently been discounted). In terms of modelling, the problem of bias in the standing sales price data set is likely to limit what can be done in the future to accurately identify the price-size relationship at small tree sizes.

The research on long-run timber prices is intended to be as complete as possible. Potential changes in the environment or environmental policy in the future were one major source of uncertainly identified in the research, but it would be very difficult to forecast the occurrence of such events. Their potential effects could be modelled in some sort of global forest model (as several institutes have already attempted to do) but this would be likely to be a substantial task. One useful thing that could be done though, would be to link the price-size relationship model with a time-series model of timber prices such as that presented in Chapter 3, to produce a model with short-run price-size forecasting capabilities. This would be a useful aid for day-to-day forest management.

The timber supply model could be improved in several respects. Improvements in yield and losses due to changes in forest management practices were identified as the two main factors likely to cause uncertainty about future timber supply. Both of these topics have been investigated in only the briefest detail so far however, and more research could be done to increase understanding in these areas. The supply forecast for hardwoods is also very crude. The data to construct a hardwood supply forecast will be improved when the Inventory of Woodlands (currently underway) is completed, but attention should also be given to why production is so far below potential and what in the future might influence this. Another topic that might be usefully investigated would be the effect that changes in demand for or supply of tropical timber would have on supply and demand for hardwoods in the UK.

Two other aspects of the timber supply research have interesting policy implications which could be investigated further. Firstly, the supply and demand for timber of different qualities could be examined. The supply and demand forecasts presented in Chapter 3 assumed that wood is a homogeneous product. British wood however tends to be of a lower quality than imported timber, and this may place constraints on the forest sector which would prevent them from achieving the estimated threefold increase in supply that is predicted. Secondly, the whole question of the need for and most appropriate way of guaranteeing long-run stability of supply to large wood processors should be investigated. The current policy of entering into long-term contract with wood-processors has been conducted for many years without a proper cost-benefit analysis of its operation, or any consideration of alternative mechanisms that could be pursued (such as the sale of future or options contracts). Given the potentially large sums of money involved, research into this should be given a high priority.

Forest recreation and community forests

Research into forest recreation and community forestry is generally at a much earlier stage of development than research into timber prices, supply and demand. This is partly because the non-market nature of recreation and community forestry outputs makes collection and interpretation of data on this topic more difficult. There are however, some areas where additional work would bring immediate improvements to the research reported here.

On the data collection side, there would be considerable merit in collecting more data from household and site surveys to validate the results presented here both in terms of forest visitor numbers and landscape preferences (this is already partly in hand). The multi-purpose dimension to forest visits should also be explored further to start to get a better idea of how much of the enjoyment of a forest visit comes from the forest itself and how much comes from other aspects of the trip. This has been an interesting issue in recreation studies for many years however, so it is likely to be difficult to make much progress in this direction. Indeed, the whole question of recreation preferences at the microeconomic level should be investigated further.

Most of the data and models presented in Chapter 4 related to England and Wales only. Progress could be made very quickly to collect and assimilate data on areas of private woodland used for recreation to combine with Forestry Commission data to create a recreational woodland database for Scotland. If future surveys in Scotland collected more detailed information about where respondents lived, then this could be used to explore more models than those currently presented in Chapter 4. However, the large area of woodland and relatively low population in Scotland would also suggest that this should be given a relatively low priority.

Probably the most important priority for further research in this area however, would be to find out how the effects of tree planting (both in terms of recreation and landscape change) change as crops mature. To paraphrase what was said in Chapter 1, the quantity, value and timing of outputs are all important factors to be considered in the appraisal of projects and policies, but this research has only addressed the quantity and to a lesser extent the value of these outputs. It has had to make assumptions about the timing of outputs because so little data has been collected in this area, but this can have a substantial effect on the preference for one type of policy or project over another.

## Conclusions

This final short section has discussed further areas where research might usefully be directed in the future. It has argued that high priority should be given to investigating the effect that environmental policy changes would have on timber supply and demand and the timing of recreation and landscape benefits. Taking into account the conclusions of the rest of this chapter, more effort should probably also be put in future into examining the non-timber outputs from forests rather than the timber outputs.

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# APPENDIX 1

## QUESTIONNAIRES USED IN THE HOUSEHOLD SURVEYS OF FOREST VISITORS 1987-1991

The following pages show the parts of the questionnaires used in the Household Surveys from 1987-1991 relating to forest visits (socio-economic information was also collected but is not shown here). The following are the main differences between the questionnaires that were used in the surveys:

1. In England and Wales, the recall period was 2 months from 1987-89 and 4 weeks from 1990-91. The recall period was 4 weeks in all the surveys in Scotland.

2. From 1987-89, respondents were asked if their last outing had been to a forest, and if so, forest visit questions were asked about their last visit. From 1990-91, respondents were asked if they had been to a forest at least once during the recall period, and if so, were asked forest visit questions about their last visit.

3. From 1987-89, respondents were asked about countryside outings in England and Wales and leisure outings in Scotland. It was not necessary to ask this at all in 1990-91.

4. In 1987 in England and Wales, respondents were given three choices of response for the location of their most recent countryside outing, one of which was woodland. In 1988-89, they were asked directly if their last outing had been to a woodland. In Scotland in 1987,

respondents were given seven choices for the location of their most recent outing, one of which was woodland. This was also replaced by a direct question in 1988-89. It was not necessary to ask this in 1990-91.

5. In March and May 1989, questions on forest visits were asked without all the preceding questions on leisure outings.

6. A visit was defined as being 3 hours or more away from home in 1987-89, and undefined (in terms of time) in 1990-91.

# Questionnaire used in the household survey of forest visitors in England and Wales January 1989 to April 1989

ASK ALL ADULTS IN ENGLAND & WALES ONLY

324 OUTINGS C

1. Have you been on an outing to the countryside in the last two months? By this, I mean an outing which lasted for three or more hours including travel time.

| | |
|---|---|
| HAS BEEN ON OUTING IN THE LAST TWO MONTHS | V→2 |
| HAS NOT BEEN ON OUTING IN THE LAST TWO MONTHS | X→N |

SHOW CARD A/324

2a. Looking at this card how would you describe the main location of your most recent day out?

| | c28 |
|---|---|
| COUNTRYSIDE/INLAND VILLAGE | V |
| OPEN COASTLINE/COASTAL VILLAGE | X |
| SEASIDE VISIT, RESORT | 0 |
| TOWN | 1 |
| CITY | 2 |

2b. Was your main destination in a woodland or forest?

| | c29 |
|---|---|
| YES, WAS | V→3 |
| NO, WASN'T | X→N |

3. On the last occasion when you went to a woodland or forest area, about how long did you spend there?

| | c30 |
|---|---|
| UP TO 1 HOUR | V |
| OVER 1 HOUR UP TO 2 HOURS | X |
| OVER 2 HOURS UP TO 3 HOURS | 0 |
| OVER 3 HOURS UP TO 4 HOURS | 1 |
| OVER 4 HOURS UP TO 5 HOURS | 2 |
| OVER 5 HOURS | 3 |
| CAN'T REMEMBER | 4 |

SHOW CARD B/324

4. During your time in the forest or woodland area, which of the things on this card did you do?

| | c31 |
|---|---|
| GO FOR A WALK ON A TRAIL OR WAYMARKED ROUTE | V |
| GO FOR A WALK - INCLUDING HIKING, JOGGING, WALKING THE DOG, ETC. | X |
| HAVE A PICNIC OR BARBECUE | 0 |
| HAVE REFRESHMENTS SUCH AS A CUP OF TEA OR A MEAL | 1 |
| OBSERVE NATURE OR WILDLIFE | 2 |
| GO AROUND THE VISITOR CENTRE | 3 |
| TAKE THE CHILDREN TO A PLAY AREA | 4 |
| USE TOILET FACILITIES | 5 |
| GO ON A FOREST DRIVE | 6 |
| RELAX-DO NOTHING, ENJOY THE SCENERY, SUNBATHE, LET THE CHILDREN PLAY | 7 |
| BUY OR GET SEEDLINGS, LOGS OR OTHER NATURAL FOREST PRODUCTS | 8 |
| WATCH A SPORTING EVENT | 9 |
| | c32 |
| TAKE PART IN SPORT | V |
| WATCH OR TAKE PART IN AN ARTS OR ENTERTAINMENT EVENT, INCLUDING THEATRE, MUSIC, PAGEANT, ETC. | X |
| OTHER W.I. & CODE → | 0 |

CONT'D ABOVE AT Q5

SHOW CARD C/324

5. And in which of these ways did you decide to go to that particular forest or woodland area on the last occasion?

| | c33 |
|---|---|
| I HAD BEEN THERE BEFORE SO I KNEW WHERE I WANTED TO GO | V |
| I FOUND IT BY CHANCE | X |
| I FOLLOWED SIGN POSTS TO IT | 0 |
| I FOUND IT ON A MAP | 1 |
| I FOUND OUT ABOUT IT FROM A TOURIST INFORMATION CENTRE | 2 |
| I HAD A LEAFLET OR ADVERT | 3 |
| FROM PERSONAL RECOMMENDATION | 4 |
| FOUND OUT ABOUT IT WHILE AT ANOTHER FOREST | 5 |
| OTHER W.I. & CODE → | 6 |
| CAN'T REMEMBER | 7 |

6. Where was the woodland or forest located?
INTERVIEWER: PROBE FULLY. PLEASE OBTAIN AS MUCH INFORMATION AS YOU CAN AS TO ITS WHEREABOUTS?
WRITE IN.

7. What was the name of the woodland or forest?
WRITE IN.

8. Was the woodland or forest public or private?

| | c34 |
|---|---|
| WAS PUBLIC | V |
| WAS PRIVATE | X |
| WAS JOINT PUBLIC/PRIVATE | 0 |
| DON'T KNOW | 1 |

SHOW CARD D/324

9. Which of these own or manage the woodland or forest?

| | c35 |
|---|---|
| FORESTRY COMMISSION | V |
| LOCAL AUTHORITY | X |
| JOINT FORESTRY COMMISSION AND LOCAL AUTHORITY | 0 |
| OTHER PUBLIC BODY WI & CODE → | 1 |
| VOLUNTARY ORGANISATION E.G. NATIONAL TRUST | 2 |
| AN INDIVIDUAL PRIVATE LANDOWNER | 3 |
| OTHER PRIVATE BODY WI & CODE → | 4 |
| JOINT PUBLIC AND PRIVATE OWNERSHIP/MANAGEMENT | 5 |
| DON'T KNOW | 6 |

10. How many days out or visits to woodland or forests have you had in the last four weeks?

| | c36 |
|---|---|
| NONE | V |
| 1 VISIT | X |
| 2 VISITS | 0 |
| 3 VISITS | 1 |
| 4 VISITS | 2 |
| 5 - 7 VISITS | 3 |
| 8 OR MORE VISITS | 4 |

# Questionnaire used in the household survey of forest visitors in England and Wales May 1989 to October 1989

ASK ALL ADULTS IN ENGLAND & WALES ONLY

455 OUTINGS C

1. Have you been on an outing to the countryside in the last two months? By this, I mean an outing which lasted for three or more hours including travel time.

| | c27 |
|---|---|
| HAS BEEN ON OUTING IN THE LAST TWO MONTHS | V → 2 |
| HAS NOT BEEN ON OUTING IN THE LAST TWO MONTHS | X → N |

SHOW CARD A/455

2a. Looking at this card how would you describe the main location of your most recent day out?

| | c28 |
|---|---|
| COUNTRYSIDE/INLAND VILLAGE | V |
| OPEN COASTLINE/COASTAL VILLAGE | X |
| SEASIDE VISIT/RESORT | 0 |
| TOWN | 1 |
| CITY | 2 |

2b. Was your main destination in a woodland or forest?

| | c29 |
|---|---|
| YES, WAS | V → 3 |
| NO, WASN'T | X → N |

3. On the last occasion when you went to a woodland or forest area, about how long did you spend there?

| | c30 |
|---|---|
| UP TO 1 HOUR | V |
| OVER 1 HOUR UP TO 2 HOURS | X |
| OVER 2 HOURS UP TO 3 HOURS | 0 |
| OVER 3 HOURS UP TO 4 HOURS | 1 |
| OVER 4 HOURS UP TO 5 HOURS | 2 |
| OVER 5 HOURS | 3 |
| CAN'T REMEMBER | 4 |

SHOW CARD B/455

4. Which of these phrases best applied to you on the last occasion you went on an outing to a forest or woodland area?

| | c31 |
|---|---|
| AT THE TIME I WAS AWAY FROM HOME ON HOLIDAY | V |
| AT THE TIME I WAS STAYING AT HOME BUT WAS ON HOLIDAY | X |
| AT THE TIME I WAS STAYING AT HOME AND IT WAS NOT DURING A HOLIDAY | 0 |
| CAN'T REMEMBER | 1 |

CONT'D PTO →

Q S 455 CONT'D

SHOW CARD C/455

5. And approximately how far did you travel on this last outing to a forest or woodland area? By this I mean the total round trip distance.

| | c32 |
|---|---|
| LESS THAN 5 MILES | V |
| 5 - 10 MILES | X |
| 11 - 20 MILES | 0 |
| 21 - 40 MILES | 1 |
| 41 - 60 MILES | 2 |
| 61 - 120 MILES | 3 |
| MORE THAN 120 MILES | 4 |
| DON'T KNOW | 5 |

6. On that outing, how many adults were in your party? Please include yourself in the number.
CODE BELOW UNDER Q6 →

| | Q6 c33 | Q7 c34 |
|---|---|---|
| NONE | - | 0 |
| ONE | 1 | 1 |
| TWO | 2 | 2 |
| THREE | 3 | 3 |
| FOUR | 4 | 4 |
| FIVE | 5 | 5 |
| SIX - TEN | 6 | 6 |
| MORE THAN TEN | V | V |
| DON'T KNOW | X | X |

7. And how many children were in your party?
CODE ABOVE AT Q7 →

SHOW CARD D/455

8. I would now like you to think about how much you personally spent on your last outing to a forest or woodland area. I am going to read out a list of items on which you may have spent money, and with the help of this card I would like you to tell me approximately how much it cost. Please do not include spending by any other members of your party.
Firstly, about how much did you spend on .....
READ OUT. ROTATE ORDER. TICK START.

| ✓ | | | NOTHING | £5 OR LESS | £6 TO £10 | £11 TO £15 | £16 TO £20 | £21 TO £30 | £31 TO £40 | MORE THAN £40 | DON'T KNOW |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | PETROL | c35 | V | X | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| | BUS OR COACH OR TRAIN FARES | c36 | V | X | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| | ADMISSION AND PARKING CHARGES | c37 | V | X | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| | FOOD AND DRINK | c38 | V | X | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| | OTHER PURCHASES AND EXTRAS SUCH AS GIFTS, ETC. | c39 | V | X | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

SHOW CARD E/455

9. During your time in the forest or woodland area, which of the things on this card did you do?

| | c40 |
|---|---|
| GO FOR A WALK ON A TRAIL OR WAYMARKED ROUTE | V |
| GO FOR A WALK - INCLUDING HIKING, JOGGING, WALKING THE DOG, ETC. | X |
| HAVE A PICNIC OR BARBECUE | 0 |
| HAVE REFRESHMENTS SUCH AS A CUP OF TEA OR A MEAL | 1 |
| OBSERVE NATURE OR WILDLIFE | 2 |
| GO AROUND THE VISITOR CENTRE | 3 |
| TAKE THE CHILDREN TO A PLAY AREA | 4 |
| USE TOILET FACILITIES | 5 |
| GO ON A FOREST DRIVE | 6 |
| RELAX-DO NOTHING, ENJOY THE SCENERY, SUNBATHE, LET THE CHILDREN PLAY | 7 |
| BUY OR GET SEEDLINGS, LOGS OR OTHER NATURAL FOREST PRODUCTS | 8 |
| WATCH A SPORTING EVENT | 9 |
| | c41 |
| TAKE PART IN SPORT | V |
| WATCH OR TAKE PART IN AN ARTS OR ENTERTAINMENT EVENT, INCLUDING THEATRE, MUSIC, PAGEANT, ETC. | X |
| OTHER W.I. & CODE → | 0 |

CONT'D ABOVE AT Q10

SHOW CARD F/455

10. And in which of these ways did you decide to go to that particular forest or woodland area on the last occasion?

| | c42 |
|---|---|
| I HAD BEEN THERE BEFORE SO I KNEW WHERE I WANTED TO GO | V |
| I FOUND IT BY CHANCE | X |
| I FOLLOWED SIGN POSTS TO IT | 0 |
| I FOUND IT ON A MAP | 1 |
| I FOUND OUT ABOUT IT FROM A TOURIST INFORMATION CENTRE | 2 |
| I HAD A LEAFLET OR ADVERT | 3 |
| FROM PERSONAL RECOMMENDATION | 4 |
| FOUND OUT ABOUT IT WHILE AT ANOTHER FOREST | 5 |
| OTHER W.I. & CODE → | 6 |
| CAN'T REMEMBER | 7 |

11. Where was the woodland or forest located?
INTERVIEWER: PROBE FULLY. PLEASE OBTAIN AS MUCH INFORMATION AS YOU CAN AS TO ITS WHEREABOUTS?
WRITE IN.

12. What was the name of the woodland or forest?
WRITE IN.

13. Was the woodland or forest public or private?

| | c43 |
|---|---|
| WAS PUBLIC | V |
| WAS PRIVATE | X |
| WAS JOINT PUBLIC/PRIVATE | 0 |
| DON'T KNOW | 1 |

SHOW CARD G/455

14. Which of these own or manage the woodland or forest?

| | c44 |
|---|---|
| FORESTRY COMMISSION | V |
| LOCAL AUTHORITY | X |
| JOINT FORESTRY COMMISSION AND LOCAL AUTHORITY | 0 |
| OTHER PUBLIC BODY WI & CODE → | 1 |
| VOLUNTARY ORGANISATION E.G. NATIONAL TRUST | 2 |
| AN INDIVIDUAL PRIVATE LANDOWNER | 3 |
| OTHER PRIVATE BODY WI & CODE → | 4 |
| JOINT PUBLIC AND PRIVATE OWNERSHIP/MANAGEMENT | 5 |
| DON'T KNOW | 6 |

15. How many days out or visits to woodland or forests have you had in the last four weeks?

| | c45 |
|---|---|
| NONE | V |
| 1 VISIT | X |
| 2 VISITS | 0 |
| 3 VISITS | 1 |
| 4 VISITS | 2 |
| 5 - 7 VISITS | 3 |
| 8 OR MORE VISITS | 4 |

# Questionnaire used in the household survey of forest visitors in England and Wales April 1990 to October 1991

**ASK ADULTS IN ENGLAND AND WALES ONLY 789 FORESTS**

Now thinking about your leisure time generally, in the last 4 weeks have you been on an outing to or visited a forest or woodland area? (27)

| | |
|---|---|
| YES - HAS VISITED FOREST/ WOODLAND AREA IN THE LAST 4 WEEKS | V --> 2 |
| NO - HASN'T VISITED FOREST/WOODLAND IN THE LAST 4 WEEKS | X --> N |

Q.2 On the last occasion when you went to a woodland or forest area, about how long did you spend there? (28)

| | |
|---|---|
| UP TO 1 HOUR | V |
| OVER 1 HOUR UP TO 2 HOURS | X |
| OVER 2 HOURS UP TO 3 HOURS | 0 |
| OVER 3 HOURS UP TO 4 HOURS | 1 |
| OVER 4 HOURS UP TO 5 HOURS | 2 |
| OVER 5 HOURS | 3 |
| CAN'T REMEMBER | 4 |

SHOW CARD A/789

Q.3 Which of these phrases best applied to you on the last occasion you went on an outing to a forest or woodland area? (29)

| | |
|---|---|
| AT THE TIME I WAS AWAY FROM HOME ON HOLIDAY | V |
| AT THE TIME I WAS STAYING AT HOME BUT WAS ON HOLIDAY | X |
| AT THE TIME I WAS STAYING AT HOME AND IT WAS NOT DURING A HOLIDAY | 0 |
| CAN'T REMEMBER | 1 |

SHOW CARD B/789

Q.4 And approximately how far did you travel on this last outing to a forest or woodland area? By this I mean the total round trip distance. (30)

| | |
|---|---|
| LESS THAN 5 MILES | V |
| 5 - 10 MILES | X |
| 11 - 20 MILES | 0 |
| 21 - 40 MILES | 1 |
| 41 - 60 MILES | 2 |
| 61 - 120 MILES | 3 |
| MORE THAN 120 MILES | 4 |
| DON'T KNOW | 5 |

Q.5 On that outing, how many adults were in your party? Please include yourself in the number
CODE BELOW UNDER Q5.

| | Q5 (31) | Q6 (32) |
|---|---|---|
| NONE | - | 0 |
| ONE | 1 | 1 |
| TWO | 2 | 2 |
| THREE | 3 | 3 |
| FOUR | 4 | 4 |
| FIVE | 5 | 5 |
| SIX - TEN | 6 | 6 |
| MORE THAN 10 | V | V |
| DON'T KNOW | X | X |

Q6 And how many children were in your party?
CODE ABOVE AT Q6

CONT'D ABOVE AT Q7

SHOW CARD C/789

Q.7 I would now like you to think about how much you personally spent on your last outing to a forest or woodland area. I am going to read out a list of items on which you may have spent money, and with the help of this card I would like you to tell me approximately how much it cost. Please do not include spending by any other members of your party. Firstly, about how much did you spend on....
READ OUT. ROTATE ORDER. TICK START.

| | | NOTHING | £5 OR LESS | £6 TO £10 | £11 TO £15 | £16 TO £20 | £21 TO £30 | £31 TO £40 | MORE THAN £40 | DON'T KNOW |
|---|---|---|---|---|---|---|---|---|---|---|
| ✓ PETROL | (33) | V | X | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| BUS OR COACH OR TRAIN FARES | (34) | V | X | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| ADMISSION AND PARKING CHARGES | (35) | V | X | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| FOOD AND DRINK | (36) | V | X | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| OTHER PURCHASES AND EXTRAS SUCH AS GIFTS, ETC. | (37) | V | X | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

SHOW CARD D/789

Q.8 During your time in the forest or woodland area, which of the things on this card did you do?

| | (38) |
|---|---|
| GO FOR A WALK ON A TRAIL OR WAYMARKED ROUTE | V |
| GO FOR A WALK INCLUDING HIKING, JOGGING, WALKING THE DOG, ETC | X |
| HAVE A PICNIC OR BARBECUE | 0 |
| HAVE REFRESHMENTS SUCH AS A CUP OF TEA OR A MEAL | 1 |
| OBSERVE NATURE OR WILDLIFE | 2 |
| GO AROUND THE VISITOR CENTRE | 3 |
| TAKE THE CHILDREN TO A PLAY AREA | 4 |
| USE TOILET FACILITIES | 5 |
| GO ON A FOREST DRIVE | 6 |
| RELAX-DO NOTHING, ENJOY THE SCENERY, SUNBATHE, LET THE CHILDREN PLAY | 7 |
| BUY OR GET SEEDLINGS, LOGS OR OTHER NATURAL FOREST PRODUCTS | 8 |
| WATCH A SPORTING EVENT | 9 |
| | (39) |
| TAKE PART IN SPORT | V |
| WATCH OR TAKE PART IN AN ARTS OR ENTERTAINMENT EVENT, INCLUDING THEATRE, MUSIC, PAGEANT, ETC. | X |
| OTHER W.I. AND CODE ------> | 0 |

CONT'D PTO

## FORESTS CONT'D

SHOW CARD E/789

Q.9 And in which of these ways did you decide to go to that particular forest or woodland area on the last occasion?

| | (40) |
|---|---|
| I HAD BEEN THERE BEFORE SO I KNEW WHERE I WANTED TO GO | V |
| I FOUND IT BY CHANCE | X |
| I FOLLOWED SIGN POSTS TO IT | 0 |
| I FOUND IT ON A MAP | 1 |
| I FOUND OUT ABOUT IT FROM A TOURIST INFORMATION CENTRE | 2 |
| I HAD A LEAFLET OR ADVERT | 3 |
| FROM PERSONAL RECOMMENDATION | 4 |
| FOUND OUT ABOUT IT WHILE AT ANOTHER FOREST | 5 |
| OTHER W.I. & CODE -------> | 6 |
| CAN'T REMEMBER | 7 |

Q 10 Where was the woodland or forest located?
INTERVIEWER: PROBE FULLY, PLEASE OBTAIN AS MUCH INFORMATION AS YOU CAN AS TO ITS WHEREABOUTS? WRITE IN.

Q.11 What was the name of the woodland or forest? WRITE IN.

Q.12 Was the woodland or forest public or private?

| | (41) |
|---|---|
| WAS PUBLIC | V |
| WAS PRIVATE | X |
| WAS JOINT PUBLIC/PRIVATE | 0 |
| DON'T KNOW | 1 |

CONT'D ABOVE AT Q13

SHOW CARD E/789

Q13 Which of these own or manage the woodland or forest?

| | (42) |
|---|---|
| FORESTRY COMMISSION | V |
| LOCAL AUTHORITY | X |
| JOINT FORESTRY COMMISSION AND LOCAL AUTHORITY | 0 |
| OTHER PUBLIC BODY WI & CODE--> | 1 |
| VOLUNTARY ORGANISATION E.G. NATIONAL TRUST | 2 |
| AN INDIVIDUAL PRIVATE LANDOWNER | 3 |
| OTHER PRIVATE BODY WI & CODE-> | 4 |
| JOINT PUBLIC AND PRIVATE OWNERSHIP/MANAGEMENT | 5 |
| DON'T KNOW | 6 |

Q14 How many days out or visits to woodland or forests have you had in the last four weeks?

| | (43) |
|---|---|
| NONE | V |
| 1 VISIT | X |
| 2 VISITS | 0 |
| 3 VISITS | 1 |
| 4 VISITS | 2 |
| 5 - 7 VISITS | 3 |
| 8 OR MORE VISITS | 4 |

# Questionnaire used in the household survey of forest visitors in Scotland February 1989 to January 1990 (ex March & May)

SECTION E - ASK ALL

Now thinking about how you spend your leisure time generally.....

E.1 SHOW CARD
In the last 4 weeks, have you had a day, or part of a day, out, which involved being away from home for at least 3 hours, for any of the leisure activities listed on this card. I am interested in both days out that you may have taken from home, or whilst on holiday in Scotland.
IF YES Which of these activities have you done on a day, or part of a day out, in the last 4 weeks?

| | (39) | | (40) |
|---|---|---|---|
| Visited a park in town/country | 1 | Visited a historic/stately home/ garden/botanic gardens | 1 |
| Gone on outing/drive for sightseeing/picnicking/sun-bathing | 2 | Visited an ancient monument/site | 2 |
| Attended a local community event (indoor/outdoor -fair/fete/show) | 3 | Visited a zoo/wildlife or safari park | 3 |
| Gone on long walks/hikes/ rambles of more than 2 miles | 4 | Visited a nature reserve/go bird-watching/go on field/nature studies | 4 |
| Gone cycling | 5 | Gone to the theatre/opera/ballet/ concert | 5 |
| Gone mountaineering/hill climbing/ rock climbing | 6 | Gone to the cinema | 6 |
| Gone fishing/hunting/shooting | 7 | Visited a museum/heritage centre | 7 |
| Taken part in water sports (sailing/rowing/canoeing/water-ski-ing/wind-surfing) | 8 | Visited an art gallery | 8 |
| Gone Ski-ing | 9 | Other (SPECIFY) ................................ | 9 |
| Taken part in any other outdoor sporting activities | 0 | None of them/not had a day out | X |
| Taken part in any other indoor sporting activities | X | | |
| Spectator at a sporting event | Y | | |

IF 'NONE OF THEM'/'NOT HAD A DAY OUT', GO TO NEXT SECTION

E.2 In total, how many 'days out' on these activities have you had in the last 4 weeks?

| | (41) |
|---|---|
| One day | 1 |
| Two days | 2 |
| Three days | 3 |
| Four days | 4 |
| 5 - 7 days | 5 |
| 8 - 14 days | 6 |
| More than 14 days | 7 |
| Don't know | Y |

E.3 Thinking about your most recent day out in the last 4 weeks, what was the main purpose of this day out?.....READ OUT

| | (42) |
|---|---|
| To visit friends/relatives | 1 |
| To visit a particular place | 2 |
| To take part/watch a particular activity | 3 |
| Going out for the day with no particular plans | 4 |
| Other (SPECIFY) ............................ | 5 |

E.4. SHOW CARD
Which of these leisure activities did you do on your most recent day out in the last 4 weeks?

| | (43) | | (44) |
|---|---|---|---|
| Visited a park in town/country | 1 | Visited a historic/stately home/ garden/botanic gardens | 1 |
| Gone on outing/drive for sightseeing/picknicking/sun-bathing | 2 | Visited an ancient monument/site | 2 |
| Attended a local community event (indoor/outdoor - fair/fete/show) | 3 | Visited a zoo/wildlife or safari park | 3 |
| Gone on long walks/hikes/ rambles of more than 2 miles | 4 | Visited a nature reserve/go bird-watching/go on field/nature studies | 4 |
| Gone cycling | 5 | Gone to the theatre/opera/ballet/ concert | 5 |
| Gone mountaineering/hill climbing/ rock climbing | 6 | Gone to the cinema | 6 |
| Gone fishing/hunting/shooting | 7 | Visited a museum/heritage centre | 7 |
| Taken part in water sports (sailing/rowing/canoeing/water-ski-ing/wind-surfing) | 8 | Visited an art gallery | 8 |
| | | Other (SPECIFY) .................................. | 9 |
| Gone Ski-ing | 9 | | |
| Taken part in any other outdoor sporting activities | 0 | None of them/not had a day out | X |
| Taken part in any other indoor sporting activites | X | | |
| Spectator at a sporting event | Y | | |

E.5 On your most recent day out in the last 4 weeks, were you.......read out

| | (45) |
|---|---|
| Away from home on holiday | 1 |
| At home, on holiday | 2 |
| At home, not on holiday | 3 |
| Don't know | 4 |

E6a) SHOW CARD
Looking at this card, how would you best describe the main location of your most recent day out?

| | (46) |
|---|---|
| Countryside/inland village | 1 |
| Open coastline/coastal village | 2 |
| Seaside visit/resort | 3 |
| Town | 4 |
| City (Edinburgh, Glasgow, Aberdeen, Dundee) | 5 |
| Other (SPECIFY) .......................... | 6 |
| Don't know | Y |

E.b) Was your main destination in a woodland or forest?

| | (47) |
|---|---|
| Yes | 1 |
| No | 2 |
| Don't know | Y |

E.7 How far did you travel on this day out?

(THE TOTAL ROUND TRIP DISTANCE)

| | (48) |
|---|---|
| Less than 5 miles | 1 |
| 5 - 10 miles | 2 |
| 11 - 20 miles | 3 |
| 21 - 40 miles | 4 |
| 41 - 60 miles | 5 |
| 61 - 120 miles | 6 |
| More than 120 miles | 7 |
| Don't know | Y |

E.8 What form of transport did you use on the longest part of your journey on this day out?

SINGLE CODE ONLY

| | (49 |
|---|---|
| Car (Own/Friends/Firms) | 1 |
| Car (Hired) | 2 |
| Lorry/Truck/Van | 3 |
| Motor cycle | 4 |
| Regular Bus/Coach | 5 |
| Organised Coach Tour | 6 |
| Train | 7 |
| Bicycle | 8 |
| Walked | 9 |
| Other (SPECIFY) ........................ | 0 |
| Don't know | Y |

E.9 How many people, both adults and children, were with you on your most recent day out? Please include yourself.

| | Adults (50) | Children (51) |
|---|---|---|
| One | 1 | 1 |
| Two | 2 | 2 |
| Three | 3 | 3 |
| Four | 4 | 4 |
| Five | 5 | 5 |
| 6 - 10 | 6 | 6 |
| More than 10 | 7 | 7 |
| Don't know | Y | Y |

E.10 SHOW CARD
How much did you spend on your most recent day out on the various items listed on this card? Please include expenditure by yourself on behalf of other members of your party.

READ OUT ITEMS ONE AT A TIME AND ROTATE ORDER OF ASKING. TICK START ALWAYS ASK 'OTHER PURCHASES' LAST

| | Petrol (52) | Bus/coach/ train fares (53) | Admission and parking charges (54) | Food and drink (55) | Other purchases and Sundries (56) |
|---|---|---|---|---|---|
| Nothing | 1 | 1 | 1 | 1 | 1 |
| £5 or less | 2 | 2 | 2 | 2 | 2 |
| £6 - £10 | 3 | 3 | 3 | 3 | 3 |
| £11 - £15 | 4 | 4 | 4 | 4 | 4 |
| £16 - £20 | 5 | 5 | 5 | 5 | 5 |
| £21 - £30 | 6 | 6 | 6 | 6 | 6 |
| £31 - £40 | 7 | 7 | 7 | 7 | 7 |
| More than £40 | 8 | 8 | 8 | 8 | 8 |
| Don't know | Y | Y | Y | Y | Y |

IF VISITED A WOODLAND/FOREST AS MAIN DESTINATION ON LAST DAY OUT AT E,6b) - COMPLETE SECTION E
OTHERS GO TO NEXT SECTION

(57

E.11 On the last occasion when you went to a woodland or forest area, about how long did you spend there?

| | |
|---|---|
| Up to 1 hour | 1 |
| Over 1 hour, up to 2 hours | 2 |
| Over 2 hours, up to 3 hours | 3 |
| Over 3 hours, up to 4 hours | 4 |
| Over 4 hours, up to 5 hours | 5 |
| Over 5 hours | 6 |
| Don't know/Can't remember | Y |

E.12 SHOW CARD
During your time in the forest or woodland area, which of the things on this card did you do?

MORE THAN ONE ANSWER ALLOWED

(58)

| | |
|---|---|
| Go for a walk on a trail or way-marked route | 1 |
| Go for a walk - including hiking, jogging, walking the dog etc | 2 |
| Have a picnic or barbecue | 3 |
| Have refreshments such as a cup of tea or a meal | 4 |
| Observe nature or wildlife | 5 |
| Go around the visitor centre | 6 |
| Take children to a play area | 7 |
| Use toilet facilities | 8 |
| Go on a forest drive | 9 |
| Relax, do nothing - enjoy the scenery, sunbathe, let the children play | 0 |

(59)

| | |
|---|---|
| Buy or get seedlings, logs or other natural forest products | 1 |
| Watch a sporting event | 2 |
| Take part in sport | 3 |
| Watch or take part in an arts or entertainment event, pageant etc | 4 |
| Other (SPECIFY) ...................................... | 5 |
| Don't know | Y |

E.13 SHOW CARD
In which of these ways did you decide to go to that particular forest or woodland area on the last occasion?

(60

| | |
|---|---|
| I had been there before so I knew where I wanted to go | 1 |
| I found it by chance | 2 |
| I followed sign posts to it | 3 |
| I found it on a map | 4 |
| I found out about it from a Tourist Information Centre | 5 |
| I had a leaflet or advert | 6 |
| Personal recommendation | 7 |
| I found out about it while at another forest | 8 |
| Other (SPECIFY) .............................................. | 0 |
| Don't know/Can't remember | Y |

| | | | |
|---|---|---|---|
| E.14a) | Where was the woodland or forest located?<br><br>WRITE IN FULL DETAILS.................................................... | | (61 |
| b) | And, what was the name of the woodland or forest?<br><br>WRITE IN ....................................................... | | |
| E.15 | Can you tell me who owns or manages the forest or woodland that you visited?<br>IF YES Was it.....READ OUT.... | | (62) |
| | | The Forestry Commission | 1 |
| | | Local Authority | 2 |
| | | Voluntary organisation e.g. The National Trust for Scotland | 3 |
| | | Private landowner | 4 |
| | | Other (SPECIFY)<br>............................... | |
| | | No, don't know who owns/ manages it | Y |
| E.16 | Finally, how many days out, or visits to woodland or forests have you taken in the last 4 weeks? | | (63) |
| | | One | 1 |
| | | Two | 2 |
| | | Three | 3 |
| | | Four | 4 |
| | | 5 - 7 | 5 |
| | | 8 or more | 6 |
| | | None | 0 |
| | | Don't know | Y |

# Questionnaire used in the household survey of forest visitors in Scotland March 1989 and May 1989

SECTION F - ASK ALL

Now thinking about how you spend your leisure time generally......

F.1 a) SHOW CARD
In the last 4 weeks, have you had a day, or part of a day, out, which involved being away from home for at least 3 hours, for any of the leisure activities listed on this card? I am interested in both days out that you may have taken away from home, or whilst on holiday, in Scotland?

| | (43) |
|---|---|
| Yes | 4 |
| No | 5 |

IF NO, NOT HAD DAY OUT, SKIP TO NEXT SECTION

b) IF YES
Was your main destination in a woodland or forest?

| | (43) |
|---|---|
| Yes | 1 |
| No | 2 |
| Don't know | Y |

IF VISITED A WOODLAND/FOREST AS MAIN DESTINATION ON LAST DAY OUT AT F.1 - COMPLETE SECTION F
OTHERS GO TO NEXT SECTION

F.2 On the last occasion when you went to a woodland or forest area, about how long did you spend there?

| | (44) |
|---|---|
| Up to 1 hour | 1 |
| Over 1 hour, up to 2 hours | 2 |
| Over 2 hours, up to 3 hours | 3 |
| Over 3 hours, up to 4 hours | 4 |
| Over 4 hours, up to 5 hours | 5 |
| Over 5 hours | 6 |
| Don't know/Can't remember | Y |

F.3 SHOW CARD
During your time in the forest or woodland area, which of the things on this card did you do?

MORE THAN ONE ANSWER ALLOWED

| | (45) |
|---|---|
| Go for a walk on a trail or way-marked route | 1 |
| Go for a walk - including hiking, jogging, walking the dog etc | 2 |
| Have a picnic or barbecue | 3 |
| Have refreshments such as a cup of tea or a meal | 4 |
| Observe nature or wildlife | 5 |
| Go around the visitor centre | 6 |
| Take children to a play area | 7 |
| Use toilet facilities | 8 |
| Go on a forest drive | 9 |
| Relax, do nothing - enjoy the scenery, sunbathe, let the children play | 0 |
| | **(46)** |
| Buy or get seedlings, logs or other natural forest products | 1 |
| Watch a sporting event | 2 |
| Take part in sport | 3 |
| Watch or take part in an arts or entertainment event, pageant etc | 4 |
| Other (SPECIFY) ............................................ | 5 |
| Don't know | Y |

| | | |
|---|---|---|
| F.4 | SHOW CARD<br>In which of these ways did you decide to go to that particular forest or woodland area on the last occasion? | (47) |
| | I had been there before so I knew where I wanted to go | 1 |
| | I found it by chance | 2 |
| | I followed sign posts to it | 3 |
| | I found it on a map | 4 |
| | I found out about it from a Tourist Information Centre | 5 |
| | I had a leaflet or advert | 6 |
| | Personal recommendation | 7 |
| | I found out about it while at another forest | 8 |
| | Other (SPECIFY)<br>.............................................. | 0 |
| | Don't know/Can't remember | Y |
| F.5a) | Where was the woodland or forest located?<br>WRITE IN FULL DETAILS. PROBE FOR EXACT LOCATION<br>................................................................ | (48) |
| b) | And what was the name of the woodland or forest?<br>WRITE IN.......................................................... | |
| F.6 | Can you tell me who owns or manages the forest or woodland that you visited? | (49) |
| | IF YES Was it...READ OUT.... The Forestry Commission | 1 |
| | Local Authority | 2 |
| | Voluntary organisation e.g. The National Trust for Scotland | 3 |
| | Private landowner | 4 |
| | Other (SPECIFY)<br>.................................... | |
| | No, don't know who owns/manages it | Y |
| F.7 | Finally, how many days out or visits to woodland or forests have you taken in the last 4 weeks? | (50) |
| | One | 1 |
| | Two | 2 |
| | Three | 3 |
| | Four | 4 |
| | 5 - 7 | 5 |
| | 8 or more | 6 |
| | None | 0 |
| | Don't know | Y |

# Questionnaire used in the household survey of forest visitors in Scotland April 1990 to October 1991

SECTION F - ASK ALL

Now some questions about visits to forest or woodland areas.........

F.1 In the last four weeks, have you been on an outing to or visited a forest or woodland area? (19)

| | |
|---|---|
| Yes | 1 |
| No | 2 |
| Don't know | Y |

IF YES, CONTINUE
IF NO, CLOSE INTERVIEW

F.2 On the last occasion when you went to a woodland or forest area, about how long did you spend there? (20)

| | |
|---|---|
| Up to 1 hour | 1 |
| Over 1 hour up to 2 hours | 2 |
| Over 2 hours up to 3 hours | 3 |
| Over 3 hours up to 4 hours | 4 |
| Over 4 hours up to 5 hours | 5 |
| Over 5 hours | 6 |
| Don't know/Can't remember | Y |

F.3 On the last occasion when you went to a forest or woodland area, were you......... READ OUT (21)

| | |
|---|---|
| Away from home on holiday | 1 |
| At home, on holiday | 2 |
| At home, not on holiday | 3 |
| Don't know | Y |

F.4 And approximately how far did you travel on this last outing to a forest or woodland area? By this, I mean the whole round trip. (22)

| | |
|---|---|
| Less than 5 miles | 1 |
| 5 - 10 miles | 2 |
| 11 - 20 miles | 3 |
| 21 - 40 miles | 4 |
| 41 - 60 miles | 5 |
| 61 - 120 miles | 6 |
| More than 120 miles | 7 |
| Don't know | Y |

F.5 How many people, both adults and children, were in your party on this last outing? Please include yourself.

| | Adults (23) | Children (24) |
|---|---|---|
| One | 1 | 1 |
| Two | 2 | 2 |
| Three | 3 | 3 |
| Four | 4 | 4 |
| Five | 5 | 5 |
| Six - Ten | 6 | 6 |
| More than ten | 7 | 7 |
| Don't know | Y | Y |

F.6 SHOW CARD

I would now like you to think about how much you personally spent on that outing to a forest or woodland area. I am going to read out a list of items and with the help of this card I would like you to tell me approximately how much you spent. Please do not include spending by any other members of your family.

Firstly, how much did you spend on ......

READ OUT ITEMS ONE AT A TIME AND ROTATE ORDER OF ASKING. TICK START. ALWAYS ASK 'OTHER PURCHASES' LAST.

| | Petrol | Bus/coach/ train fares | Admission and parking charges | Food and drink | Other purchases and Sundries |
|---|---|---|---|---|---|
| | (25) | (26) | (27) | (28) | (29) |
| Nothing | 1 | 1 | 1 | 1 | 1 |
| £5 or less | 2 | 2 | 2 | 2 | 2 |
| £6 - £10 | 3 | 3 | 3 | 3 | 3 |
| £11 - £15 | 4 | 4 | 4 | 4 | 4 |
| £16 - £20 | 5 | 5 | 5 | 5 | 5 |
| £21 - £30 | 6 | 6 | 6 | 6 | 6 |
| £31 - £40 | 7 | 7 | 7 | 7 | 7 |
| More than £40 | 8 | 8 | 8 | 8 | 8 |
| Don't know | Y | Y | Y | Y | Y |

F.7 SHOW CARD

During your time in the forest or woodland area, which of the things on this card did you do?

MORE THAN ONE ANSWER ALLOWED

| | (30) |
|---|---|
| Go for a walk on a trail or way-marked route | 1 |
| Go for a walk - including hiking, jogging, walking the dog etc | 2 |
| Have a picnic or barbecue | 3 |
| Have refreshments such as a cup of tea or a meal | 4 |
| Observe nature or wildlife | 5 |
| Go around the visitor centre | 6 |
| Take children to a play area | 7 |
| Use toilet facilities | 8 |
| Go on a forest drive | 9 |
| Relax, do nothing - enjoy the scenery, sunbathe, let the children play | 0 |
| | (31) |
| Buy or get seedlings, logs or other natural forest products | 1 |
| Watch a sporting event | 2 |
| Take part in sport | 3 |
| Watch or take part in an arts or entertainment event, pageant etc | 4 |
| Other (SPECIFY) .............................. | 5 |
| Don't know | Y |

| | | |
|---|---|---|
| F.8 | SHOW CARD<br>In which of these ways did you decide to go to that particular forest or woodland area on the last occasion? | (32 |
| | I had been there before so I knew where I wanted to go | 1 |
| | I found it by chance | 2 |
| | I followed sign posts to it | 3 |
| | I found it on a map | 4 |
| | I found out about it from a Tourist Information Centre | 5 |
| | I had a leaflet or advert | 6 |
| | Personal recommendation | 7 |
| | I found out about it while at another forest | 8 |
| | Other (SPECIFY)<br>.................................................... | 0 |
| | Don't know/Can't remember | Y |
| F.9a) | Where was the woodland or forest located?<br>WRITE IN FULL DETAILS.......................................<br>.............................................................. | (33) |
| b) | And, what was the name of the woodland or forest?<br>WRITE IN ........................................................ | (34) |
| F.10 | Can you tell me who owns or manages the forest or woodland that you visited?<br>IF YES Was it....... READ OUT | (35) |
| | The Forestry Commission | 1 |
| | Local Authority | 2 |
| | Voluntary organisation e.g. The National Trust for Scotland | 3 |
| | Private landowner | 4 |
| | Other (SPECIFY)<br>................................. | |
| | No, don't know who owns/manages it | Y |
| F.11 | Finally, how many days out or visits to woodland or forests have you taken in the last <u>4 weeks</u>? | (36) |
| | One | 1 |
| | Two | 2 |
| | Three | 3 |
| | Four | 4 |
| | 5 - 7 | 5 |
| | 8 or more | 6 |
| | None | 0 |
| | Don't know | Y |
| F.12 | Can you tell me what age you are?<br>WRITE IN [ (37) \| (38) ] | |

# APPENDIX 2

## CONSTRUCTION OF THE FOREST RECREATION DATABASES

For the purpose of identifying the ownership of woodland recorded in the survey and to analyse the supply of forests for recreation, two databases of forest sites were constructed. A database of non Forestry Commission woodland was constructed based on the location mentioned by respondents in the surveys from 1987-1991, supplemented with other information collected about woodland sites where recreation is permitted. A second database was also constructed from the Forestry Commission's own forest management database, taking into account the accessibility and appropriate size of the Commission's forests used for recreation. This appendix discusses the construction of these databases and the coverage of the data contained within them. It finishes with a discussion of the number of sites where more than just woodland was on offer to the visitor.

### Construction of the database of non Forestry Commission woodland

Data sheets were sent to the Forestry Commission by the surveyors, containing answers to questions in the survey about the location of the last forest visited. An example of such a data sheet is given overleaf. Where these did not refer to Forestry Commission woodlands, the names of the locations were put onto a computer database recording: county, main name, other name, ownership (where that could be determined) of the woodland, and type of woodland (eg woodland, wooded parkland, woodland with water feature etc).

OMNIMAS - FORESTS WEEK: 42

| S/N | Q10 LOCATION | Q11 - NAME OF WOODLAND/ FOREST | TOWN /VILLAGE (WHERE RESP LIVES) |
|---|---|---|---|
| 32705 | WIMPOLE | NATIONAL TRUST WIMPOLE | CHATTERIS. CAMBS |
| 16212 | ORMSKIRK WEST HEAD | WEST HEAD | LIVERPOOL MERSEYSIDE |
| 16209 | BEWST-Y- COED WALES | DK | LIVERPOOL MERSEYSIDE |
| 16205 | LANCASHIRE | DK | LIVERPOOL MERSEYSIDE |
| 56803 | SNODLAND | DK. | SNODLAND KENT |
| 32304 | SPAIN | LLIENCRES | SOUTH WINGFIELD DERBYSHIRE |
| 32302 | SHAWS WOOD. SOUTH WINGFIELD | SHAWS WOOD SOUTH WINGFIELD | SOUTH WINGFIELD DERBYSHIRE |

Some of the responses included county name, and where this occurred, county name was checked against other location names given in the response to check validity. Where county name was not given, a map gazetteer (Bartholomews, 1989) showing both town names and county names was used to ascertain county (most responses included at least a town or county name). In only a few circumstances, the name of the location could not be identified, and records had to be discarded.

The name of the woodland, where given, was taken as the main name and if possible, names of parts of woodland were avoided. So, for example, the name of picnic sites, visitor centres, and individual stopping places were avoided where possible. The name of the nearest town or village, where given, was put under the other name to aid identification of these woods on Ordnance Survey maps. In some cases, only the name of the nearest town or village was given, because the respondent did not know the name of the wood, in which case this was coded as the main name.

Ownership of the woodland was identified using several sources of information. An examination of Forestry Commission land record maps enabled Forestry Commission owned sites to be identified. These were removed from the database because they were already recorded on the Forestry Commission's own forest management database. (However, areas close to Forestry Commission woodlands but not actually owned by the Forestry Commission were included eg Beaulieu in the New Forest.) To establish local authority ownership, a list of locations, names and areas of all country parks, was obtained from the Countryside Commission. This list also contained data on country parks that receive Countryside Commission aid but are either privately owned or owned by the voluntary organisations. Water company land holdings were identified in the database from their annual reports, and National Trust publications were used to confirm or identify National Trust ownership.

This left a large number of sites where ownership was very difficult to identify. Some of these were quite well known publicly owned sites (eg Burnham Beeches, Epping Forest), privately owned sites (eg Chatsworth, Sandringham) or sites owned by voluntary groups (eg Wandlebury) where ownership could be identified, others were more difficult to identify. However, in some cases, the name of the wood gave a clue as to who owned the site. For example, if the work "park" appeared in the name of the forest, and its ownership status could not be found by any other means, this was taken to mean local authority ownership in an urban context and private ownership if the location was definitely rural. In a similar way, some sites were recorded as farms, race courses, golf courses, and military camps and ownership was estimated accordingly. This process required some judgement and was by no means foolproof, but it dramatically reduced the uncertainty of forest ownership recorded in the survey.

The sources of information that were used to identify ownership (various water company annual reports; National Trust Publications (National Trust, 1989 and 1991); Countryside Commission lists; and lists of private sites (eg National Gardens Scheme, 1989)), also contained names of other sites not recorded in the survey that had woodland open for recreation. Where descriptions in these publications included references to woodlands or woodland walks, these were added to the database to make it more complete. In all, 1,471 sites in England

and Wales were recorded as having woodland available for public recreation.

With a complete set of forest names, the next exercise was then to locate each forest, and record the grid reference and area of the forest against its name. This was in order to estimate total supply of forests available and distance to starting locations. The forests generally fell into three categories that were treated as follows:

a. Many records contained the exact name and location of a forest. These were ideal answers and it was generally very easy to get grid reference and area. Examples include: Alton Towers; Dunkery Beacon; Wellbeck Estate and Epping Forest. Most private estates, farms, country parks and National Trust properties could be clearly located in this way, and their area calculated.

b. Quite a few answers gave the name of the nearest town to a wood, but no name of the wood itself. This enabled location to be recorded, but area of forest had to be estimated. This was a matter of judgment in some cases because sometimes no obvious forest could be found on the map. If a forest or forests could be found within 2 kilometres of the continuous boundary of the town referred to on an OS map, this was taken to be the forest the respondent was referring to. Its area was then recorded against the name of the town. If no forest could be found or the town was so large as to make a sensible identification of the site visited by the respondent impossible, then the location of the town was recorded in the database and nothing else.

c. The third type of answer referred to very large and sometimes scattered forest areas. In this case, the area of forest was taken to be the area apparently covered by the relevant name on an OS 1:50 000 map. This again required judgement where forests were made up of scattered blocks (eg Quantock Forest, Brendon Hills), or one very large continuous block (eg many of the forests in National Parks). The fact that Forestry Commission sites were not included in this database made this easier because many of these fell into this category. Where a large area included both Forestry Commission and other woodland, only the area of non Forestry Commission woodland was included. The most central location of the woodland was recorded, thus making it only an approximate location.

The 8-figure grid reference for each of these sites was first obtained from a gazetteer (Ordnance Survey, 1969). Maps were then used to check and modify these references where necessary, and calculate area of forest as represented by the Ordnance Survey area of woodland ("green-plate") or area of parkland as identified on the map.

Construction of the Forestry Commission database

Identification of Forestry Commission sites was generally much easier because they are better signposted and publicised so respondents tended to know their names, and measurement was easy because the Forestry Commission has its own land area database.

The basic unit of Forestry Commission management is the subcompartment, which is a unit of roughly between 0.25-50 hectares, containing trees planted at the same time and managed in the same way (eg planted at a uniform spacing and thinned according to a specified regime). They can also contain open land and recreational areas owned by the Forestry Commission. One or more subcompartments are combined to form compartments which generally range between 2-100 hectares in size. These units were designed for forest management and both are generally below the amount of forest that a visitor would encounter on a trip to the forest (ie a visitor would probably traverse or be surrounded by more than one compartment on a visit to the forest). The next level of definition on the Forestry Commission database is the old administrative unit of the forest block, and then the new administrative unit of the Forest District. Both of these were really too large to describe the area visited on a forest trip because they cover many thousands of hectares, and often contain scattered blocks of trees separated by large distances. So, none of the Forestry Commission's standard classifications of forest blocks were felt to be appropriate as regards measuring areas of woodland that might be visited.

However, for the purposes of open market valuation forest compartments had recently been aggregated into valuation blocks, defined as a group of contiguous compartments, separated from other blocks by intervening land not owned by the Forestry Commission and other major features such as roads and rivers. These were limited to a maximum size of about 1 000 hectares and were considered to be much closer to the area that would be encountered by forest. They also seemed to be similar in size to the forests identified in the non-Forestry Commission sites (see Table 4.3.2). These were used as the definition of a forest block for the purpose of assessing areas visited on recreation trips.

The next problem was to identify exactly which of these blocks would be likely to be used for recreation. Some blocks cannot be used by the public because of restrictive titles in deeds, or because they require access across another landowner's property. Others are unlikely to be used because they are very remote from public roads and contain little or no provision for access. To identify blocks that were likely to be used for recreation, two additional pieces of information were obtained. A list of the locations of all car parks, including both Forestry Commission car parks and car parks owned by others but used by forest visitors, was collected by means of a survey of forest managers. To this, was added a list of all subcompartments coded as having a recreation land use. From these lists, blocks containing or adjacent to one or more car parks or other recreation land uses were identified and used as the database of Forestry Commission forests used for recreation. Nearly all the locations in this database were referred to in responses to the survey, and only in eight cases did respondents refer to having visited a woodland that was identified as being in Forestry Commission ownership but not counted in the database.

Coverage of the database

Because the starting location for forest visits was only known for trips originating in England and Wales, the database was only completed for forest areas there. Data for the Forestry Commission was complete for the whole of Great Britain, and since this accounts for much of the woodland with recreational facilities in the Scottish Borders, it is unlikely that this will cause much bias in the estimates of forest supply in England and Wales. Summaries of the coverage of the database by ownership category are given in the following tables. The rest of this appendix discusses the accuracy and appropriateness of the data collected in this exercise as a measure of recreational woodland supply.

Woodland in public ownership

a. Forestry Commission

The subcompartment database contains the total area of all woodland, both productive woodland and other wooded land, and other land owned or managed by the Forestry Commission. The Forestry Commission has a policy of open access and positively encourages recreation on its estate, but there are some circumstances where it is restricted. About 25% hectares of the 893 000 hectares managed by the Forestry Commission are leased, and in many cases, sporting rights and other restrictions in the lease prevent the Commission from allowing recreation on this land. A much smaller amount of land requires access across another landowner's estate, which is usually only permitted for Forestry Commission employees in the course of their normal duties. However, a fair proportion of this is also included in the figure for leased land, so the addition to the total amount of land not accessible for this reason is likely to be very small. The only other factor that will influence accessibility is the provision of facilities that enable or encourage access to the estate.

Chapter 2 discussed the variety of recreation facilities that are present in Forestry Commission forests. Fortunately, many of these sites are identified on the Commission's land database, so their location and the area of forest that they serve can be identified.

However, unless they cover a significant area, and that area is solely devoted to the recreation facility they will not be recorded as a recreation land use. So, for example, most camping and caravan sites, picnic sites, visitor centres and forest gardens will be identified on the database but many forest walks, nature trails, forest drives and some car parks will not.

To overcome this problem, the location of all Forestry Commission car parks, and car parks owned by other organisations within or adjoining Commission woods, was obtained by means of a survey of forest managers supplemented by examination of maps. Most facilities have a car park for visitors even if the facilities themselves are not identified on the database. All forest blocks that contained one or more recreation facilities or car parks were then identified by finding the block closest to each facility or car park using their grid references. Table 4.2.1 summarises the areas of Commission woodland that contained facilities or car parks to encourage recreation in the woods. By using the survey of car parks, it was also possible to assign a quite detailed name to most of these blocks which helped the process of identifying locations from survey responses.

Table 4.2.1 - Presence of recreation facilities and car parks in Forestry Commission woodland

| Country | Forest Area (1991) | Number of Forest Blocks | Blocks containing facilities or car parks | | | |
|---|---|---|---|---|---|---|
| | | | Number | Area | % Number | % Area |
| England | 274 172 | 1,400 | 331 | 134 578 | 24 | 49 |
| Wales | 139 091 | 1,073 | 98 | 30 695 | 9 | 22 |
| Scotland | 720 966 | 1,591 | 217 | 131 675 | 14 | 18 |
| Great Britain | 1 134 229 | 4,064 | 646 | 296 948 | 16 | 26 |

Only forest blocks which contained a facility or car park were included on the database of forest recreation sites. Therefore, only 26% of the total forest area owned by the Forestry Commission was included on the database as recreational forests.

b. Local authorities

The database contained the location and area of all local authority country parks containing woodland. Most country parks are wooded to some extent, but by no means does the area of country parks equate to the area of woodland in country parks. Where an area of woodland within a country park could be identified from maps and this was found to differ substantially from the area of the park, the latter was substituted in the database.

Other local authority land on the database included major forest areas owned by the Corporation of London (eg Burnham Beeches and Epping Forest) and other local authorities plus the area of urban parks where these had been recorded in the survey as the destination of a forest visit. The total coverage of local authority parks, country parks and other woodland on the database is shown in Table 4.2.2.

Table 4.2.2 - Area and number of local authority woodlands contained on the database

| | Country Parks | | Urban Parks | | Other Woodland | | Total | |
|---|---|---|---|---|---|---|---|---|
| Country | Number | Area | Number | Area | Number | Area | Number | Area |
| England | 166 | 19,081 | 35 | 3,819 | 17 | 618 | 218 | 23,518 |
| Wales | 23 | 3,607 | 2 | 10 | 2 | 9 | 27 | 3,626 |

It is likely that the area of woodland in country parks is less than that recorded on the database because of open space within these areas. Similarly, for urban parks, the total area of the park could only be identified from maps, so this was used, although it is likely to overestimate the true wooded area.

Only a few of the many urban parks containing woodland or at least some tree cover are likely to have been captured by this survey, so on the whole, the figures for urban park woodland are likely to be vast underestimates of the area of this resource as a whole. The same is true of other local authority woodland, because in only a few cases was it known for sure that a certain piece of woodland belonged to a local authority. So, some woodland might have been captured but coded as unknown ownership, and some might have been missed altogether.

Local authorities generally grant access and promote recreation on all their land holdings, where that does not conflict with other objectives. So the total area captured is also likely to be the area accessible and where recreation is allowed, subject to the limitations noted above. These areas also tend to have good provision of facilities for recreation, making them easily accessible to the visitor. A further complication arises however, because local authorities also enter into joint access and management agreements with other landowners where this would meet the local authorities recreation objectives. This is the case with the 32 country parks identified that are not in local authority ownership and with probably quite a few other woods. In these cases, the ownership of the woodland or park was recorded in the database, but it must be borne in mind that this further underestimates the influence of, and resources committed by local authorities in the promotion of woodland recreation.

c. The National Trust for England and Wales

The National Trust is a significant woodland owner. It also owns vast areas of parkland which appeared in the survey as locations of woodland visits. Most properties are open to the public.

In an attempt to obtain a complete enumeration of National Trust woodland and wooded parkland, a variety of National Trust publications were obtained which gave the location of all their properties open to the public. From these, all the properties indicating woodland or parkland in their descriptions were extracted. Grid references were also given in many cases, and some descriptions even included the area of parkland or woodland. Where this was not available, these variables were ascertained by examining maps. The resulting areas are summarised in Table 4.2.3. By including parkland, these areas again overestimate the figure for true woodland areas, but as with country parks, it is difficult to distinguish between woodland and areas of very open woodland or sparse tree cover. It is likely that these figure include all accessible woodland owned by the National Trust.

Table 4.2.3 - National Trust woodland/parkland

| | Woodland Sites | | Parkland Sites | | Total | |
|---|---|---|---|---|---|---|
| | Number | Area | Number | Area | Number | Area |
| England | 176 | 16 626 | 37 | 6 359 | 13 | 22 985 |
| Wales | 14 | 278 | 5 | 864 | 19 | 1 142 |

d. Voluntary organisations

Voluntary organisations were also identified as woodland owners in the survey, and this is a small but growing sector of woodland owners. The two main owners are the RSPB and Woodland Trust which own some 11 000 ha (England only) of woodland between them. However much of this is for conservation rather than recreation, and facilities are limited. Other owners include county naturalist trusts, local trusts and preservation societies. The two major owners provided lists of names and locations of woodland where recreation is encouraged, and these were incorporated into the database. Other than woodlands in these 2 ownerships coverage was very low and generally, only those sites owned by voluntary groups and designated as country parks were identified while others were either misclassified or missed altogether. However, many of the woodlands owned by other voluntary groups are more orientated towards conservation rather than recreation so, the coverage of sites where access is encouraged may again actually be better than appears to be the case.

e. Other public ownership

The Crown Estate Commissioners, Universities, English Heritage, Ministry of Defence, and nationalised industries such as British Coal, all own woodland. Woodlands in the database that fell into this category were identified from maps, annual reports, guide books and personal knowledge wherever possible. It is likely that the database does not include all the woodland available for recreation in this category.

Woodland in private ownership

Subtracting from the 2½ million hectares of total woodland, 860 000 hectares of Forestry Commission woodland and say, 50 000 hectares of other non-privately owned woodland, it can be deduced that the remaining 1.6 million hectares of woodland in Great Britain is in private ownership. It is this woodland that caused both the most difficulty in terms of identifying ownership, and also the most problems in defining what is and isn't accessible.

a. Water authorities

Some of the survey responses gave the name of a reservoir as the location of a woodland visit. Many other recreation surveys have found that the presence of water greatly enhances the recreation outing, so this result is not surprising. Wherever water and woodland come together, the potential for recreation is often great. The references to reservoirs in the survey were supplemented by information provided by the major water companies in England and Wales about where recreation is encouraged on their water and adjoining land holdings. From this set of locations, those reservoirs without no adjoining woodland were removed, and the area of woodland adjoining each of the remaining reservoirs was estimated from maps. These woodlands were all attributed to water authority ownership, although that may not be the case in all locations. Where the woodland was in some other easily identifiable ownership such as local authority ownership (eg Macclesfield Forest) or Forestry Commission ownership (eg around Lake Vrnwy, and the Derwentwater and Ladybower Reservoirs) this could be avoided, but it is likely that there is still some misclassification, particularly of woodland adjoining reservoirs where the reservoir is only owned by a small water company. Coverage of woodland adjoining reservoirs owned by the large (ie publicly listed) water companies in England and Wales should be complete, but coverage of woodland owned by smaller companies is probably underestimated.

Access is currently encouraged by the large water companies, and they also tend to own some land surrounding their reservoirs as well. So, the database probably includes all accessible woodland owned by them. Smaller companies do not tend to have such large adjoining land holdings so it is possible that in terms of accessible woodland, coverage from the survey responses only, might be better than at first appears. In total, 50 sites accounting for 2,300 hectares of woodland were estimated to be in water company ownership in England and Wales.

b. Private landowners

Two publications on historic houses and gardens were used to identify forests visited that were in private ownership, and other privately owned properties containing woodland walks that were not captured in the survey (National Gardens Scheme, 1989; British Leisure Publications, 1990).

The remaining woodland in the database was coded as probably privately owned except in circumstances where its location raised serious doubts as to whether it might be owned by another owner such as a local authority, but not captured elsewhere, in which case ownership was recorded as don't know.

Types of different woodland recorded on the database

Many of the locations identified on the woodland databases were sites containing more than just woodland. Many sites were wooded parkland containing areas of open ground as well as woodland, others contained water features such as rivers or reservoirs, some included houses, monuments and gardens, and several were sites where the woodland was obviously only of secondary importance (eg zoos, safari parks, sporting venues and amusement parks). It is questionable whether some of the visits to these sites could be considered as truly woodland visits (ie they would have probably taken place in the absence of woodland), so an attempt was made to identify those sites where the woodland was a joint attraction with some other feature and the proportion of sites in each of the main categories identified in England and Wales is shown in Table 4.2.4.

Table 4.2.4 - Proportion of sites and visits in England and Wales made to locations where woodland was not the only attraction

| Site Type | Number of Sites | Total Area | % of Woodland Area | % of Woodland Area |
|---|---|---|---|---|
| Woodland the main attraction | | | | |
| Woodland | 949 | 210 542 | 78.0 | 76.9 |
| Wooded parkland | 294 | 31 704 | 11.8 | 20.3 |
| Woodland nature reserve | 14 | 782 | 0.3 | 0.1 |
| Woodland only part of attraction | | | | |
| Woodland with water feature | 147 | 8 826 | 3.3 | 0.6 |
| Woodland with house/garden/monument | 143 | 15 077 | 5.6 | 1.2 |
| Woodland only a secondary attraction | | | | |
| Commercial leisure facility in woodland | 26 | 2 875 | 1.1 | 0.9 |

It is not possible to calculate the proportion of benefit from a recreation visit that is attributable to the woodland component of a site. All that can be said is that, going down the list of site types in Table 4.2.4, the proportion of the benefit that can be attributed to the woodland at each site probably diminishes. It is only likely to be 100% at the top of the list in exceptional cases and similarity, at the bottom of the list it is likely to be above zero.

The vast majority of woodland visits were in the two categories of woodland and wooded parkland implying that most of the visits recorded in the survey were considered by respondents to be mainly woodland visits. Similarly, the relatively low proportion of visits to woodland mixed with other features suggested that possibly more visits had been made to such sites than were recorded in the survey, but that respondents had not considered them to be woodland visits when responding to the survey. It can therefore be concluded that while all visits are to some extent multi-purpose visits, the number of visits recorded in the survey is a reasonable estimate of visits where the main purpose of the visit was to visit woodland.

# Information sent to respondents in the survey of the three lead community forests

Southern Staffordshire
Community Forest
49 Park Road
Cannock
Staffordshire
WS11 1JN

FORESTS FOR THE COMMUNITY

21 January 1992

Dear Resident

Over the past year you may have heard of, or seen, the work that my team and I are doing to help people in this area enjoy the nearby countryside.

We hope in the coming years to build a better environment for local people by improving the appearance of land near to built-up areas, and by enabling people to go into the countryside to enjoy it.

I am writing to ask for your help by letting me have your own opinions about the importance and value of what we are working to achieve, and would be most grateful if you could spare a few minutes to look through the brochure I enclose which explains in more detail what we have in mind.

Some time in the next week or so, we will be visiting households who have received this letter to carry out an opinion survey. Your household has been chosen with a number of others to ensure that we meet a representative sample of local people.

If you have any points you would like to make to me personally, or any questions you would like to ask, do please write to me at the above address. In the meantime, I should like to wish you a happy new year.

Yours sincerely

G.M. Hunt

Graham Hunt
Project Director

FORESTS FOR THE COMMUNITY

# FOREST OF MERCIA

FORESTS FOR THE COMMUNITY

England is a beautiful country famous for its hills and open spaces, farmland, rivers and woods.

**Community Forests** are a new idea from the Forestry Commission and the Countryside Commission to bring the countryside closer to towns.

The Forest of Mercia is one of the first new Community Forests based in Staffordshire.

## CLOSE TO HOME

Countryside close to our homes is special but the outskirts of many of our towns and cities are scarred by the remains of heavy industry, coal mining and quarries. They need not stay like that.

Community Forests will combine farmland and woodland, trees, hedges and fields to allow people to walk and relax in the countryside close to their homes.

## LOCAL FORESTS FOR LOCAL PEOPLE

You will be the most important user of the new community forest and your opinions will help decide how the forest develops. Schools, farmers, landowners, amenity societies, businesses and local residents will all have the opportunity to play a part in shaping their local countryside through a **forest plan** and through their local authority.

## WHY TREES?

Woodlands give shelter in winter and shade in summer. They can be a habitat for wildlife, a place for children to play safely away from traffic – an environment to be quietly enjoyed by all.

Trees can be used to screen buildings and ugly developments helping industry, which provides jobs and wealth, fit more easily into the landscape.

Trees close to homes make our suburbs a better place to live.

### EXERCISING

Walking
Jogging
Cycling
Horseriding
Wayfaring
Orienteering

### ENJOYING

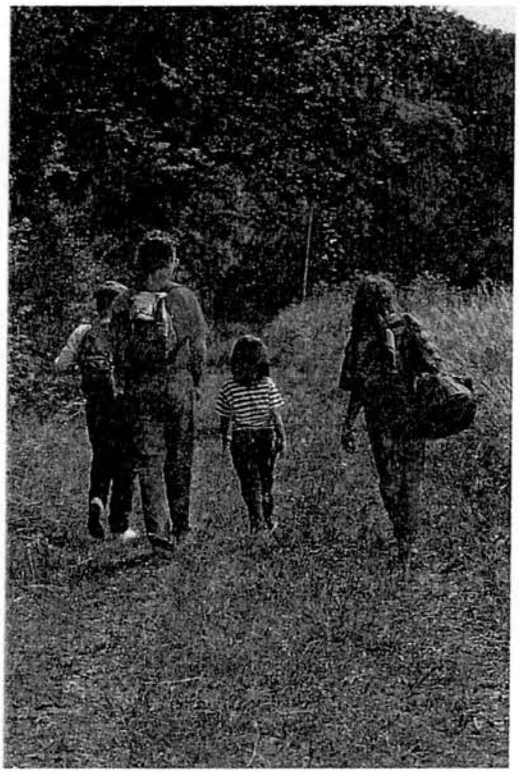
Adventure
Picnics
Camping
Exploring
Playing
Relaxing
Birdwatching
Flowers
Painting
Photography

### LEARNING

Nature
Trees
Animals
Insects
Farming
Food
Crops
Countryside
Weather
Seasons
Landscapes

### TRYING YOUR HAND

Planting
Weeding
Digging
Draining
Managing
Planning
Protecting
Designing
Teaching
Fencing



## USING THE FOREST

At the moment much of the countryside in this part of Staffordshire is not open for all to enjoy. Community Forests will encourage landowners to allow access into the countryside where you'll be able to try some of the pastimes listed.

## LANDOWNERS AND FARMERS

The Community Forest will be created within a working farming landscape where farmers will be able to explain to visitors about the countryside. City dwellers will experience the seasonal changes of a countryside environment in an urban setting.

## BUSINESS IN THE COMMUNITY

Businesses will benefit in a number of ways whilst also contributing by improving their surrounding environment. They may also become more involved in the community by sponsoring projects within the forest and find they attract new customers through offering a pleasant working environment.

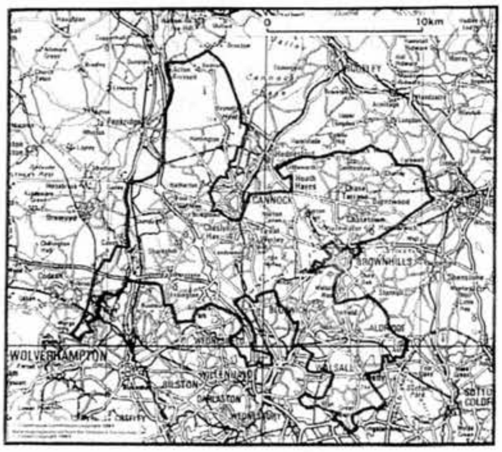
## A PARTNERSHIP

It will take a lifetime to see the forest grow to maturity but young trees can very quickly start to alter the landscape, providing shelter and habitat for wildlife and an ever-changing interest for local people.

Each Community Forest has a Project Team to plan the forest, advise landowners and make sure that local people are involved. The teams are managed by a partnership of local authorities, voluntary groups and experts from the Forestry and Countryside Commissions.

The Forest of Mercia is supported by the local councils of Staffordshire County Council, South Staffordshire, Cannock Chase and Lichfield District Councils and Walsall Borough Council.

# FOREST OF MERCIA




**Forest of Mercia** is one of twelve **Community Forests** being established throughour England.

**Community Forests** cover large areas on the edges of towns and cities where major environmental improvements will create well-wooded landscapes.

Covering more than 63 square miles (16,300 ha), **Forest of Mercia** will provide extensive opportunities for:

- a thriving forestry and farming industry with increased scope for diversification,
- recreation – walking, riding, sports and much more,
- education – as an outdoor classroom,
- new habitats for wildlife,

**Forest of Mercia** is an important new initiative led by the Countryside Commission and Forestry Commission. It will be shaped by landowners, farmers and local communities for their own work and enjoyment and that of their children and grandchildren.

FORESTS FOR THE COMMUNITY

COUNTRYSIDE COMMISSION

Forestry Commission

Produced by Carstairs · Forsyth · Newsome Associates

Printed by Studio Print

## Questionnaire used in the survey of the three lead community forests

**Dear Resident,**

We are conducting an opinion survey to find out how much local people have heard about Forest of Mercia Community Forest project, and how much they would value that kind of development in this area.

It would help us enormously if you would take a few minutes to answer our questions.

All replies will be treated anonymously.

When we have finished, the total views of the local residents will be presented to the Forestry Commission to assist them in meeting the needs of the Community.

Q1 YOU SHOULD HAVE RECEIVED SOME INFORMATION ABOUT THE FOREST OF MERCIA COMMUNITY FOREST PROJECT FROM THE PROJECT DIRECTOR, GRAHAM HUNT (SHOWCARD B). HAVE YOU HAD TIME TO LOOK AT THIS ?
(Please circle one answer only)

| | |
|---|---|
| 1 Yes - In Full | 1 |
| 2 Yes - Glanced At It | 2 |
| 3 No (Leave a copy if asked to do so) | 3 |

Q2 CAN YOU TELL ME WHERE YOU FIRST HEARD OF THE COMMUNITY FORESTS OR THE FOREST OF MERCIA ?
(Please circle one answer only)

| | |
|---|---|
| 1 The Information Leaflet | 1 |
| 2 National Press | 2 |
| 3 Local Press | 3 |
| 4 Radio | 4 |
| 5 Television | 5 |
| 6 Word Of Mouth | 6 |
| 7 Not Heard Of It Before | 7 |
| 8 Other | 8 |

Please Specify ____________________

Q3 (USING SHOWCARD A) THE IDEA OF THE FOREST OF MERCIA IS TO CREATE A MORE WOODED AND MORE VARIED LANDSCAPE WITH OPPORTUNITIES FOR PEOPLE TO GET INVOLVED IN ITS PLANNING AND USE IT FOR OUTDOOR ACTIVITIES. IT WILL COVER THE AREA BETWEEN WALSALL AND STAFFORD, STRETCHING FROM LICHFIELD IN THE EAST TO AS FAR AS WOLVERHAMPTON IN THE WEST. THIS COVERS 65 SQUARE MILES OVERALL, OF WHICH UP TO ONE-THIRD MAY BE PLANTED WITH TREES. WOULD YOU SAY THAT YOU KNOW THIS AREA WELL ?
(Please circle one answer only)

| | |
|---|---|
| 1 Don't Know The Area At All | 1 |
| 2 Know A Little About The Area | 2 |
| 3 Know The Area Quite Well | 3 |
| 4 Know The Area Very Well | 4 |
| 5 Don't Know | 5 |

Q4 THESE PICTURES HAVE BEEN TAKEN IN THE AREA RECENTLY (SHOWCARD C)WOULD YOU AGREE THAT THEY GIVE AN ACCURATE IMPRESSION OF THE AREA ?
(Please Circle ONE answer ONLY)

| | |
|---|---|
| 1 Yes | 1 |
| 2 No | 2 |
| 3 Don't Know | 3 |

Q5 JUDGING BY THE PHOTOGRAPHS I HAVE JUST SHOWN YOU AND YOUR OWN PERSONAL KNOWLEDGE, HOW WOULD YOU RATE THE EXISTING AREA FOR OUTDOOR RECREATION NEEDS ?
(Please Circle ONE answer ONLY)

| | |
|---|---|
| 1 Doesn't Meet My Outdoor Recreation Needs At All | 1 |
| 2 Meets Some Of My Outdoor Recreation Needs | 2 |
| 3 Meets Most Of My Outdoor Recreation Needs | 3 |
| 4 I Am Perfectly Happy With The Recreation opportunities Available In The Area | 4 |
| 5 Don't Know | 5 |

COULD YOU TELL ME HOW OFTEN YOU TAKE PART IN THESE SPARE TIME ACTIVITIES ? (ONLY DAY VISITS, AND NOT ACTIVITIES DONE WHILST ON HOLIDAY)
(Please circle one answer only)
(1- Daily, 2-Weekly, 3-More Than Once A Month, 4- Once A Month, 5- Once A Quarter, 6- Less Than Once A Quarter, 7- Never)

Q6 Visit A Local Park Or Country Park 1 2 3 4 5 6 7

Q6a Do You Do This Activity All Year Or Just Some Months ?
1 2 3 4 5 6 7 8 9 A B C
Circle as many as applicable J F M A M J J A S O N D

Q7 Visit Cannock Chase 1 2 3 4 5 6 7

Q7a Do You Do This Activity All Year Or Just Some Months ?
1 2 3 4 5 6 7 8 9 A B C
Circle as many as applicable J F M A M J J A S O N D

Q8 Watch Outdoor Sports 1 2 3 4 5 6 7

Q8a Do You Do This Activity All Year Or Just Some Months ?
1 2 3 4 5 6 7 8 9 A B C
Circle as many as applicable J F M A M J J A S O N D

Q9 Visit Other Parts Of The Local Countryside 1 2 3 4 5 6 7

Q9a Do You Do This Activity All Year Or Just Some Months ?
1 2 3 4 5 6 7 8 9 A B C
Circle as many as applicable J F M A M J J A S O N D

Q10 Visit The Countryside On A Journey Of 30 Miles Or More 1 2 3 4 5 6 7

Q10a Do You Do This Activity All Year Or Just Some Months ?
1 2 3 4 5 6 7 8 9 A B C
Circle as many as applicable J F M A M J J A S O N D

Q11 Other Outdoor Activities 1 2 3 4 5 6 7

Q11a Do You Do This Activity All Year Or Just Some Months ?
1 2 3 4 5 6 7 8 9 A B C
Circle as many as applicable J F M A M J J A S O N D

Q12 IF THE FOREST OF MERCIA GOES AHEAD AS PROPOSED, IT WILL GREATLY INCREASE YOUR OPPORTUNITIES FOR COUNTRYSIDE RECREATION. THESE PHOTOGRAPHS (SHOWCARD E) ILLUSTRATE WHAT THE AREA MIGHT LOOK LIKE AFTER THE FOREST HAS BEEN PLANTED. HOW WOULD YOU SAY IT COMPARES TO THE AREA AS IT IS NOW ?
(Please circle one answer only)

| | |
|---|---|
| 1 They Look Much Better Than The Area Currently Looks | 1 |
| 2 They Look Better Than The Area Currently Looks | 2 |
| 3 They Look Same As The Area Currently Looks | 3 |
| 4 They Look Worse Than The Area Currently Looks | 4 |
| 5 They Look Much Worse Than The Area Currently Looks | 5 |
| 6 Don't Know | 6 |

Q13 IF A COMMUNITY FOREST WAS ALREADY ESTABLISHED IN YOUR AREA, HOW OFTEN, APPROXIMATELY, WOULD YOU AND/OR YOUR FAMILY EXPECT TO MAKE A VISIT ?
(Please circle one answer only)

| | |
|---|---|
| 1 Daily | 1 |
| 2 Weekly | 2 |
| 3 More Than Once A Month | 3 |
| 4 Once A Month | 4 |
| 5 Once A Quarter | 5 |
| 6 Less Than Once A Quarter | 6 |
| 7 Never | 7 |

Q13a Do You Do This Activity All Year Or Just Some Months ?
1 2 3 4 5 6 7 8 9 A B C
Circle as many as applicable J F M A M J J A S O N D

Q13b ON EACH VISIT, HOW MANY PEOPLE WOULD BE LIKELY TO GO WITH YOU ?

Please Specify ____________

Q14 IF NONE FROM Q13, WHY DON'T YOU THINK YOU WOULD EVER VISIT THE FOREST OF MERCIA ?

Please Specify ________

Q15 HOW YOU NORMALLY TRAVEL TO THE FOREST OF MERCIA ?
(Please circle one answer only)

| | |
|---|---|
| 1 Car/Motorcycle | 1 |
| 2 Bus | 2 |
| 3 Walk | 3 |
| 4 Bicycle | 4 |
| 5 Don't Know | 5 |
| 6 Other | 6 |

Please Specify ____________

Q16 FROM THE LIST BELOW WHICH THREE ACTIVITIES DO YOU THINK THAT YOU WOULD BE MOST LIKELY TO TAKE PART IN ?
(Please circle any Three answers)

| | |
|---|---|
| 1 Walk The Dog | 1 |
| 2 Go On A Sign Posted Walk | 2 |
| 3 Go For A Walk Off The Beaten Track | 3 |
| 4 Have A Picnic Or Barbecue | 4 |
| 5 Relax/Sunbathe | 5 |
| 6 Take The Children To A Play Area | 6 |
| 7 Watch Sport/Games | 7 |
| 8 Participate In Sport/Games | 8 |
| 9 Watch Or Take Part In Organised Events | 9 |
| A Buy Refreshments | A |
| B Ride A Bicycle | B |
| C Ride A Horse | C |
| D Go On A Forest Drive | D |
| E Observe Nature Or Wildlife | E |
| F Other | F |

Please Specify ____________

THE FOREST OF MERCIA WILL NOT GENERATE ENOUGH INCOME TO BE SELF SUPPORTING. THE FOREST WILL THEREFORE REQUIRE SUPPORT FROM LOCAL COUNCILS WHOSE RESOURCES WOULD PROBABLY HAVE TO COME FROM TAXES IN ONE FORM OR ANOTHER. IF EVERYONE IN THE AREA HAD TO PAY FOR THIS FOREST.

WHAT IS THE MOST YOU PERSONALLY WOULD WILLINGLY PAY TO SEE THE PROJECT GO AHEAD ? PLEASE GIVE ME AN AMOUNT PER MONTH OR PER VISIT TO THE FOREST
(If answer is none code 999)

Q17 Amount Per Month ____________
OR
Q18 Amount Per Visit ____________

Q18a IS THAT AMOUNT FOR YOURSELF OR FOR THE WHOLE HOUSE HOLD ?
(Please circle one answer only)

| | |
|---|---|
| 1 Yourself | 1 |
| 2 Household | 2 |

Q18b IF FOR THE HOUSEHOLD, HOW WOULD YOU BE WILLING TO PAY PER PERSON ?

Please Specify ____________

Q19 WHICH OF THE FOLLOWING BEST DESCRIBES YOUR REASONS FOR BEING UNWILLING TO PAY ANY MORE ?
(Please circle one answer only)

| | |
|---|---|
| 1 You Do Not Think It Is Worth Paying Any More For The Forest Of Mercia | 1 |
| 2 You Would Rather See The Money Spent On Other Public Services | 2 |
| 3 You Would Agree To Something Being Spent, But Not If It Meant Higher Taxes | 3 |
| 4 You Would Not Use The Forest Of Mercia | 4 |
| 5 You Do Not Think That The Last Question Was A Sensible One | 5 |
| 6 Don't Know | 6 |
| 7 Other | 7 |

Please specify ____________

Q20 CAN YOU TELL ME IF YOU ARE A MEMBER OF ANY COUNTRYSIDE OR CONSERVATION ORGANISATION, IF SO WHICH ONE ?

Please Specify ____________ (Write 'None' If None)

Q21 WOULD YOU DESCRIBE YOURSELF AS THE HEAD OF THE HOUSEHOLD ?
(please circle one answer only)

| | |
|---|---|
| 1 Yes | 1 |
| 2 No | 2 |

Q22 DO YOU OR YOUR FAMILY UNIT HAVE ACCESS TO A CAR FOR YOUR PRIVATE USE ?
(please circle one answer only)

| | |
|---|---|
| 1 Yes | 1 |
| 2 No | 2 |

Q23 IN WHICH OF THE FOLLOWING RANGES OF ANNUAL FAMILY INCOME WOULD YOU PLACE YOURSELF ?
(Please circle one answer only)

| | |
|---|---|
| 1 £0 - £5,000 | 1 |
| 2 £5,001 - £10,000 | 2 |
| 3 £10,001 - £15,000 | 3 |
| 4 £15,001 - £20,000 | 4 |
| 5 £20,001 - £30,000 | 5 |
| 6 Over £30,000 | 6 |

Q24 HOW MANY PEOPLE ARE THERE IN YOUR FAMILY WHO ALSO LIVE AT THIS ADDRESS ?

Please specify ____________

Q25 SEX OF INTERVIEWEE ?
(Please circle one answer only)

| | |
|---|---|
| 1 Male | 1 |
| 2 Female | 2 |

Q26 AGE OF INTERVIEWEE ?

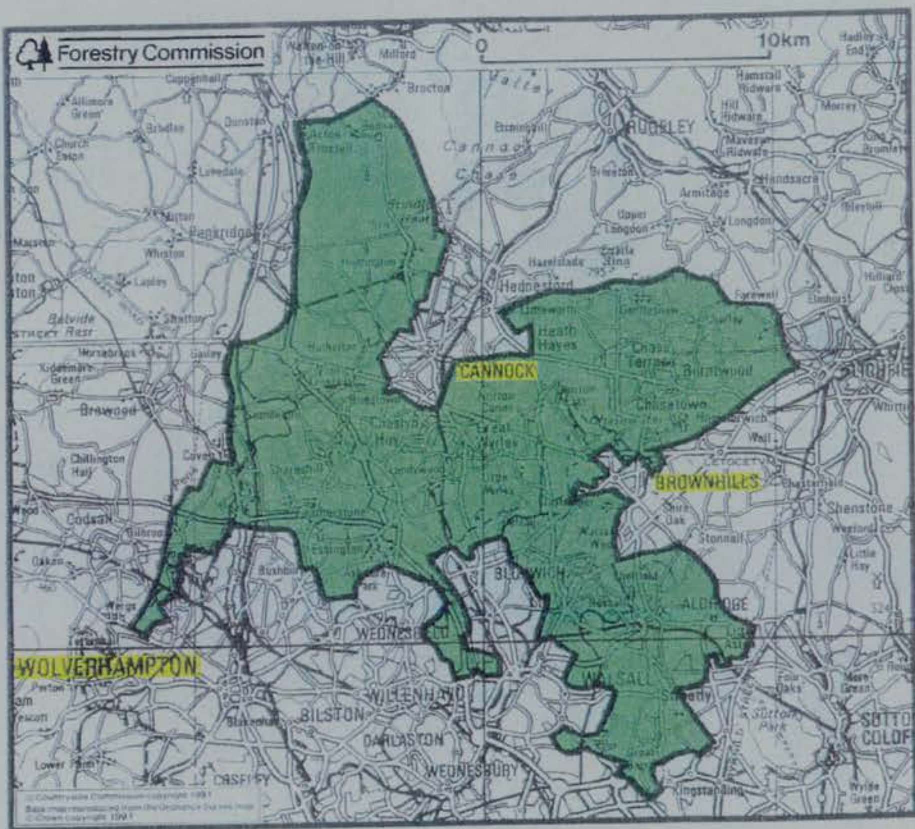
Please Specify ____________

Q27 TIME ____
(Nearest Hour In 24 Hour Format)

INTERVIEWER (Initials) __ __ NUMBER ______

[thank respondent]

## Maps and photographs used in the survey of the three lead community forests



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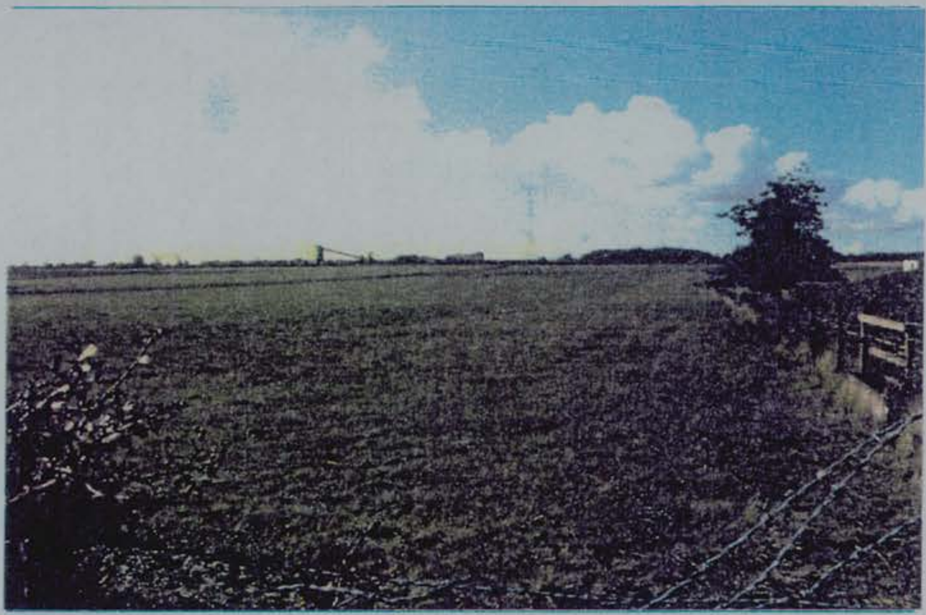

# AFTER

# AFTER

# AFTER

# Questionnaire used in the survey of landscape preferences in Red Rose Forest

**HELP US TO HELP YOU**

Dear Resident

We are conducting a survey to find out how much people have heard about the Red Rose Community Forest, and what they think of such a project.

It would help us enormously if you would take a few minutes to answer our questions. All replies will be treated anonymously.

When we have finished, the views of local residents will be presented to the Red Rose Community Forest team, to assist them in meeting the needs of the local community.

**1** CAN YOU TELL ME IF YOU HAVE HEARD OF COMMUNITY FORESTS OR THE RED ROSE FOREST ?
(Please Circle ONE answer ONLY)

| | | |
|---|---|---|
| 1 | Yes | 1 |
| 2 | No IF NO GOTO Q4 | 2 |

**2** WHERE DID YOU FIRST HEAR ABOUT IT ?
(Please Circle ONE answer ONLY)

| | | |
|---|---|---|
| 1 | National press | 1 |
| 2 | Local press | 2 |
| 3 | Radio | 3 |
| 4 | Television | 4 |
| 5 | Word of mouth | 5 |
| 6 | Other (Specify) | 6 |

Specify ______________________

**3** CAN YOU TELL ME WHICH PARTS OF GREATER MANCHESTER WILL THE FOREST COVERS ?
(Circle as many as applicable)

| | | |
|---|---|---|
| 1 | Wigan | 1 |
| 2 | Bolton | 2 |
| 3 | Bury | 3 |
| 4 | Trafford | 4 |
| 5 | Salford | 5 |
| 6 | Manchester | 6 |
| 7 | Rochdale | 7 |
| 8 | The Western Part | 8 |
| 9 | Don't Know | 9 |
| 10 | Other (Specify) | 10 |

Specify ______________________

READ ALOUD:

THE IDEA OF THE RED ROSE FOREST IS TO CREATE A MORE WOODED AND MORE VARIED LANDSCAPE WITH OPPORTUNITIES FOR PEOPLE TO GET INVOLVED IN ITS PLANNING AND USE IT FOR OUTDOOR ACTIVITIES. IT WILL COVER THE SIX DISTRICTS OF WIGAN, BOLTON, BURY, TRAFFORD, SALFORD AND MANCHESTER. OF THIS AREA, UP TO ONE THIRD MAY BE PLANTED WITH TREES.

**4** WOULD YOU SAY THAT YOU KNOW THIS AREA WELL?
(Please Circle ONE Answer ONLY) *SHOWCARD 1*

| | | |
|---|---|---|
| 1 | Don't know the area at all | 1 |
| 2 | Know a little of the area | 2 |
| 3 | Know the area quite well | 3 |
| 4 | Know the area very well | 4 |
| 5 | Don't Know | 5 |

**5** JUDGING BY YOUR KNOWLEDGE OF THE AREA, HOW WOULD YOU RATE IT AT PRESENT FOR MEETING YOUR OUTDOOR RECREATION NEEDS ? *SHOWCARD 2*
*(Please Circle ONE Answer ONLY)*

| | | |
|---|---|---|
| 1 | Doesn't meet my needs at all | 1 |
| 2 | Meets some of my needs | 2 |
| 3 | Meets most of my needs | 3 |
| 4 | I am very happy with the outdoor recreation opportunities available in the area | 4 |
| 5 | Don't know | 5 |

COULD YOU TELL ME HOW OFTEN YOU TAKE PART IN THESE SPARE TIME ACTIVITIES DURING SUMMER (APRIL-SEPTEMBER) AND WINTER (OCTOBER-MARCH) ? (ONLY ACTIVITIES DONE FROM HOME, NOT INCLUDING THOSE PURSUED ON HOLIDAY)
Code as:

1= daily; 2= 4-5 times a week; 3= 2-3 times a week;
4= once a week; 5= once every two weeks; 6= once a month;
7= once every 2 months; 8= once every 3 months;
9= every 6 months; 10= never.

**6** VISIT A LOCAL PARK OR COUNTRY PARK
*(Please Circle ONE answer ONLY for Summer and Winter)*

| | |
|---|---|
| Summer | 1 2 3 4 5 6 7 8 9 10 |
| Winter | 1 2 3 4 5 6 7 8 9 10 |

**7** WATCH OR PLAY OUTDOOR SPORTS
*(Please Circle ONE answer ONLY for Summer and Winter)*

| | |
|---|---|
| Summer | 1 2 3 4 5 6 7 8 9 10 |
| Winter | 1 2 3 4 5 6 7 8 9 10 |

8 VISIT OTHER PARTS OF THE LOCAL COUNTRY SIDE
*(Please Circle ONE answer ONLY for Summer and Winter)*

| | |
|---|---|
| Summer | 1 2 3 4 5 6 7 8 9 10 |
| Winter | 1 2 3 4 5 6 7 8 9 10 |

9 VISIT THE COUNTRYSIDE ON A JOURNEY OF 30 MILES OR MORE
*(Please Circle ONE answer ONLY for Summer and Winter)*

| | |
|---|---|
| Summer | 1 2 3 4 5 6 7 8 9 10 |
| Winter | 1 2 3 4 5 6 7 8 9 10 |

10 IF THE RED ROSE FOREST GOES AHEAD AS PLANNED,, IT WILL GREATLY INCREASE YOUR OPPORTUNITIES FOR COUNTRYSIDE RECREATION.

IF IT WAS ALREADY ESTABLISHED IN YOUR AREA, HOW OFTEN WOULD YOU EXPECT TO MAKE A VISIT ?
*(Please Circle ONE answer ONLY for Summer and Winter)*

| | |
|---|---|
| Summer | 1 2 3 4 5 6 7 8 9 10 |
| Winter | 1 2 3 4 5 6 7 8 9 10 |

11 IF YOUR RESPONSE TO ABOVE IS NEVER, WHY DO YOU THINK YOU WOULD NEVER VISIT RED ROSE FOREST ?

Specify ____________________

GO TO Q015

12 ON EACH VISIT, HOW MANY PEOPLE WOULD BE LIKELY TO GO WITH YOU?

Specify ____________________

13 AND HOW WOULD YOU MOST LIKE TO GET TO THE FOREST THAT WILL BE CREATED ?
*(Please Circle ONE Answer ONLY)*

| | | |
|---|---|---|
| 1 | Car | 1 |
| 2 | Motorcycle | 2 |
| 3 | Bus | 3 |
| 4 | Walk | 4 |
| 5 | Bicycle | 5 |
| 6 | Don't know | 6 |
| 7 | Other (Specify) | 7 |

Specify ____________________

14 FROM THIS LIST ,WHICH THREE ACTIVITIES DO YOU THINK YOU WOULD BE MOST LIKELY TO PART IN THE FOREST ?
*(Circle any THREE answers)* *SHOWCARD 3*

| | | |
|---|---|---|
| 1 | Walk the dog | 1 |
| 2 | Go on a signposted walk or trail | 2 |
| 3 | Go for a walk off the beaten track | 3 |
| 4 | Have a picnic or barbecue | 4 |
| 5 | Relax / Sunbathe / do nothing | 5 |
| 6 | Take children to play a game | 6 |
| 7 | Watch sport / games | 7 |
| 8 | Play sport / games | 8 |
| 9 | Watch or take part in organised events | 9 |
| 10 | Buy refreshments | 10 |
| 11 | Ride a bicycle | 11 |
| 12 | Ride a horse | 12 |
| 13 | Observe nature or wildlife | 13 |
| 14 | Other (Specify) | 14 |

Specify ____________________

15 IF CYCLEWAYS WERE PROVIDED IN YOUR AREA, WOULD YOU BE LIKELY TO USE THEM?
*(Please circle ONE answer ONLY)*

| | | |
|---|---|---|
| 1 | Sometimes | 1 |
| 2 | Often | 2 |
| 3 | Never | 3 |
| 4 | Don't know | 4 |

**I AM NOW GOING TO ASK YOU SOME QUESTIONS ABOUT THE VISUAL APPEARANCE OF THE AREA AROUND WESTERN MANCHESTER.**

16 DOES THE CURRENT APPEARANCE OF THE AREA CONCERN YOU AT ALL? *SHOWCARD 4*
*(Please circle ONE answer ONLY)*

| | | |
|---|---|---|
| 1 | I am very concerned about how the area looks | 1 |
| 2 | I am quite concerned with how the area looks | 2 |
| 3 | I am not really bothered about the appearance of the area | 3 |
| 4 | Don't know | 4 |

17 DO YOU THINK IT LOOKS ATTRACTIVE?
*(Circle ONE answer ONLY)* *SHOWCARD 5*

| | | |
|---|---|---|
| 1 | Looks very unattractive | 1 |
| 2 | Looks quite bad | 2 |
| 3 | Doesn't look that bad | 3 |
| 4 | Looks quite nice | 4 |
| 5 | Don't know | 5 |

18 DO YOU THINK PLANTING MORE WOODLAND WOULD IMPROVE THE AREA SIGNIFICANTLY ? *SHOWCARD 6*
*(Please Circle ONE answer ONLY)*

| | | |
|---|---|---|
| 1 | Improve the area greatly | 1 |
| 2 | Improve the area slightly | 2 |
| 3 | Not improve the area | 3 |
| 4 | Make the area look worse | 4 |
| 5 | Don't know | 5 |

19 IF RESPONSE TO ABOVE IS "NOT IMPROVE THE AREA" OR "TO MAKE THE AREA LOOK WORSE", WHY DO YOU THINK THIS IS?

Specify ____________________

20 WHAT DO YOU THINK WOULD BE THE MOST IMPORTANT THINGS THE RED ROSE FOREST COULD DO TO IMPROVE THE LOCAL AREA ?
*(Circle as many as applicable)*

| | | |
|---|---|---|
| 1 | Screen roads / buildings | 1 |
| 2 | Cover spoil heaps / derelict land | 2 |
| 3 | Provide somewhere to go for a walk | 3 |
| 4 | Provide somewhere for children to play | 4 |
| 5 | Increase the number of street trees in the city | 5 |
| 6 | Don't know | 6 |
| 7 | Provide areas for sport | 7 |
| 8 | Promote economic regeneration | 8 |
| 9 | Improve education about the environment | 9 |
| 10 | Improve community spirit | 10 |
| 11 | Nothing | 11 |
| 12 | Other (Specify) | 12 |

Specify ____________________

21 IF WOODLANDS WERE PLANTED NEAR WHERE YOU LIVE, ARE THERE ANY ASPECTS OF THIS YOU WOULD NOT LIKE ?
*(Circle as many as applicable)*

| | | |
|---|---|---|
| 1 | None | 1 |
| 2 | Litter / illegal tipping | 2 |
| 3 | Vandalism | 3 |
| 4 | Safety / things lurking in the woods | 4 |
| 5 | Blocking views / shading out light | 5 |
| 6 | Falling leaves | 6 |
| 7 | Ugly / untidy appearance | 7 |
| 8 | Don't know | 8 |
| 9 | Other (Specify) | 9 |

Specify ____________________

22 I WOULD NOW LIKE TO SHOW YOU SOME PHOTOGRAPHS OF WHAT THE AREA CURRENTLY LOOKS LIKE, AND WHAT IT MIGHT LOOK LIKE AFTER THE FOREST IS PLANTED. WOULD YOU BE PREPARED TO SPEND A FEW MORE MINUTES LOOKING AT THESE AND ANSWERING SOME QUESTIONS ABOUT THEM?
*(Circle ONE answer ONLY)*

1 Yes 1
2 No IF NO GOTO Q31 2

23 HERE ARE 6 PHOTOGRAPHS OF THE RED ROSE FOREST AREA.
*(SELECT 6 OF THE 15 PHOTOGRAPHS AS IN PHOTOGRAPH SCHEDULE, AND PLACE NEXT TO EACH OTHER ON A FLAT SURFACE SUCH AS A TABLE OR BOARD)*

THINKING ABOUT THE NEAREST OPEN SPACE TO WHERE YOU LIVE, I WOULD LIKE YOU TO STUDY THESE AND PUT THEM IN THE ORDER IN WHICH YOU WOULD MOST PREFER THAT AREA TO LOOK LIKE.

PLEASE TAKE AS LONG AS YOU LIKE AND FEEL FREE TO MOVE THE PHOTOGRAPHS AROUND IF THAT WILL HELP YOU.
*(Circle ONE answer in each row ONLY - take numbers from reverse of photographs)*

23.1 FIRST CHOICE (MOST PREFERRED)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

23.2 SECOND CHOICE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

23.3 THIRD CHOICE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

23.4 FOURTH CHOICE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

23.5 FIFTH CHOICE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

23.6 SIXTH CHOICE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

24 DO YOU CURRENTLY RENT OR OWN YOUR OWN HOME?
*(Circle ONE answer ONLY)*

1 Own 1
2 Rent 2
3 Live with Friends / Relatives 3

25 WHAT SORT OF PROPERTY DO YOU LIVE IN?
*(Circle ONE answer ONLY)*

1 Flat 1
2 Detached House 2
3 Terraced House 3
4 Semi-detached House 4
5 Other 5

Specify ______________________________

26 IT IS SOMETIMES SUGGESTED THAT CHANGING THE LOCAL ENVIRONMENT CAN AFFECT PROPERTY VALUES. IF THE RED ROSE FOREST RESULTED IN TREES BEING PLANTED AND MORE OPPORTUNITIES FOR RECREATION BEING PROVIDED IN THE NEAREST OPEN SPACE TO YOU, DO YOU THINK THAT WOULD HAVE AN EFFECT ON PROPERTY VALUES WHERE YOU LIVE?
*(Circle ONE answer ONLY)*

1 Yes 1
2 No 2
3 Don't know 3

27 IF NO FROM Q26 WHY NOT?
*(Circle ONE answer ONLY)*

1 I Don't Believe This Would Affect Property Values 1
2 I Live In The Inner City / Too Far Away 2
3 Other Things Have More Effects On Prices 3
4 Other 4

Specify ______________________________

YOU HAVE JUST RANKED THESE TWO PHOTOGRAPHS IN ORDER OF PREFERENCE
*(TAKE TWO PHOTOGRAPHS FROM THE SIX AS IN THE PHOTOGRAPH SCHEDULE)*

*SHOW LOWER RANKED PHOTOGRAPH*

SUPPOSING YOU WERE THINKING NOW OF BUYING / RENTING A PROPERTY SIMILAR TO THE ONE YOU CURRENTLY LIVE IN, WHAT IS THE MOST YOU THINK YOU WOULD BE WILLING TO PAY FOR IT IN TERMS OF RENT OR PURCHASE PRICE IF IT WAS IN AN AREA THAT LOOKED LIKE THIS?
*(Circle ONE photograph Number ONLY)*

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

28A PURCHASE PRICE

Specify £________
OR
28B WEEKLY RENT

Specify £________

*SHOW HIGHER RANKED PHOTOGRAPH*

AND HOW MUCH IF THE AREA WAS CHANGED TO LOOK LIKE THIS?
*(Circle ONE photograph Number ONLY)*

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

29A PURCHASE PRICE

Specify £________
OR
29B WEEKLY RENT

Specify £________

30 IF THE RESPONSE IS THE SAME TO Q28/29 - WHICH OF THE FOLLOWING BEST DESCRIBES YOUR REASONS FOR BEING UNWILLING TO PAY ANY MORE TO LIVE IN THE AREA YOU PREFER?
*(Circle ONE answer ONLY)*

1 The Change Is So Small, I Don't Think It Would Be Worth Paying For 1
2 I Don't Think The Change Would Have A Major Effect On Property Values 2
3 I Already Pay Enough To My Landlord 3
4 I Couldn't Afford It / Get a Mortgage 4
5 I Don't Think The Question Was Sensible 5
6 I Have Better Things To Spend My Money On 6
7 Don't Know 7
8 Other 8

Specify ______________________________

I WOULD NOW LIKE TO ASK YOU JUST A FEW MORE QUESTIONS ABOUT YOUR SELF

31 CAN YOU TELL ME IF YOU OR A MEMBER OF YOUR FAMILY ARE A MEMBER OF A COUNTRYSIDE OR CONSERVATION ORGANISATION AND IF SO WHICH ONE

Specify ______________________________

32 **WOULD YOU DESCRIBE YOURSELF AS THE HEAD OF THIS HOUSEHOLD?**
*(Circle ONE answer ONLY)*

| | | |
|---|---|---|
| 1 | Yes | 1 |
| 2 | No | 2 |

33 **DO YOU OR YOUR FAMILY HAVE ACCESS TO A CAR FOR YOUR PRIVATE USE?**
*(Circle ONE answer only)*

| | | |
|---|---|---|
| 1 | Yes | 1 |
| 2 | No | 2 |

34 **IN WHICH OF THE FOLLOWING RANGES OF ANNUAL FAMILY INCOME WOULD YOU PUT YOURSELF?**
*(Circle ONE answer ONLY)*

| | | |
|---|---|---|
| 1 | Under £5000 | 1 |
| 2 | £5,001 - £10,000 | 2 |
| 3 | £10,001 - £15,000 | 3 |
| 4 | £15,001 - £20,000 | 4 |
| 5 | £20,001 - £30,000 | 5 |
| 6 | Over £30,000 | 6 |

35 **HOW MANY PEOPLE ARE THERE IN YOUR FAMILY THAT LIVE AT THIS ADDRESS?**

Specify ____________________

36 **SEX OF INTERVIEWEE?**
*(Circle ONE answer ONLY)*

| | | |
|---|---|---|
| 1 | Male | 1 |
| 2 | Female | 2 |

37 **AGE OF INTERVIEWEE?**

Specify ____________________

38 **ARE YOU REGISTERED DISABLED OR IN RECEIPT OF DISABILITY BENEFIT OF SOME KIND?**
*(Circle ONE answer ONLY)*

| | | |
|---|---|---|
| 1 | Yes | 1 |
| 2 | No | 2 |

39 **ETHNIC BACKGROUND OF INTERVIEWEE?**
*(Circle ONE answer ONLY)*

| | | |
|---|---|---|
| 1 | White | 1 |
| 2 | Chinese / South - East Asian | 2 |
| 3 | Indian / Pakistani / Bangladeshi | 3 |
| 4 | African / Afro-Caribbean | 4 |
| 5 | Arabic / Middle Eastern | 5 |

40 **INTERVIEWEES ADDRESS - POSTCODE, STREET & TOWN**

Specify ____________________

____________________

____________________

Photographs used in the landscape preference survey in Red Rose Forest (reduced to 50% actual size)

Low–lying farmland

Moorland

Rolling farmland

Rural fringe

Urban fringe